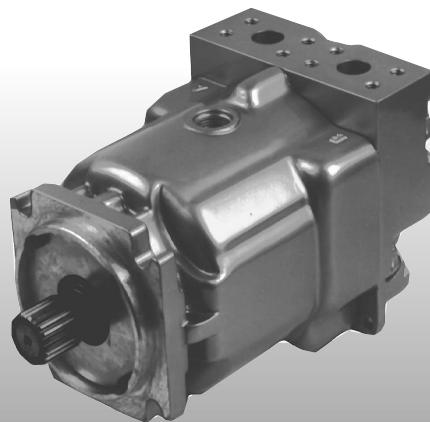
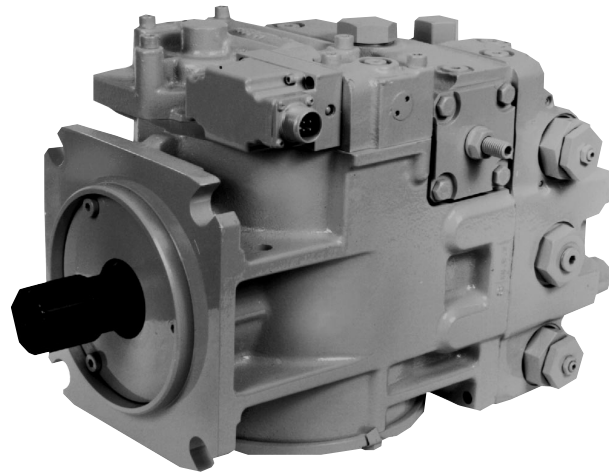




SAUER SUNDSTRAND

Series 90



Axial Piston

Pumps and Motors

Repair Manual

General Description

Series 90 Variable Displacement Pumps are cradle swashplate design units, incorporating parallel axial pistons with slippers.

These pumps are designed to be combined with other products in closed circuit systems to transfer and control hydraulic power.

The pump output flow rate is proportional to the pump's input speed and is determined by the swashplate angle, which may be infinitely varied between zero and maximum displacement.

The pump's flow direction is reversed by tilting the swashplate to the opposite side of the zero displacement position.

A compact, responsive, closed loop servo system, with a choice of manual, hydraulic, or electrical input, controls the swashplate angle. An automotive drive control is also available.

Series 90 Fixed and Variable Displacement Motors are swashplate design units, incorporating parallel axial pistons with slippers.

These motors are primarily designed to be combined with other products in closed circuit systems to transfer and control hydraulic power.

The output speed is proportional to the flow rate of the hydraulic fluid through the motor (and the motor displacement, for variable motors). Output torque is proportional to the difference in the pressure levels in the high and low sides of the fluid circuit.

The motor's direction of rotation depends on the direction of fluid flow through the motor.

Variable Displacement Motors are available with 2-position electric solenoid or hydraulic displacement control, and utilize internally supplied servo pressure. Variable motors normally start at maximum displacement. Activation of the motor control results in the motor shifting to minimum displacement.

- **The Series 90 — Advanced Technology Today**
- **The Most Technically Advanced Hydraulic Units in the Industry**
- **8 Sizes of Variable Displacement Pumps**
- **6 Sizes of Fixed Displacement Motors**
- **Complete Family of Control Systems**
- **Proven Reliability and Performance**
- **Optimum Product Configurations**
- **Compact, Lightweight**



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Introduction

This manual provides “Major Repair” procedures for the Series 90 variable displacement pumps and fixed and variable displacement motors.

Minor Repairs are those repairs which can be performed without removing the end cap or side cover. These repairs can be performed by any customer without affecting the unit warranty. These repairs are described in the “Series 90 — Service Manual,” Bulletin BLN-9947.

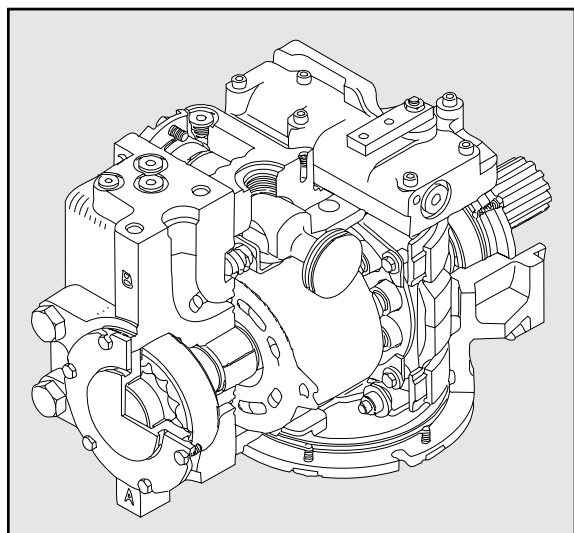
Major Repairs are those repairs which require the removal of the end cap or side cover. These repairs are to be performed only by Sauer-Sundstrand Authorized Service Centers and/or original equipment manufacturers who have been adequately trained by Sauer-Sundstrand to perform these repairs. Performing major repairs on the Series 90 products may affect the unit warranty status, thus the factory should be consulted prior to undertaking such repairs.

These repair procedures, when used in conjunction with the Series 90 Service manual, Bulletin BLN-9947, provide complete service and repair information for the Series 90 products.

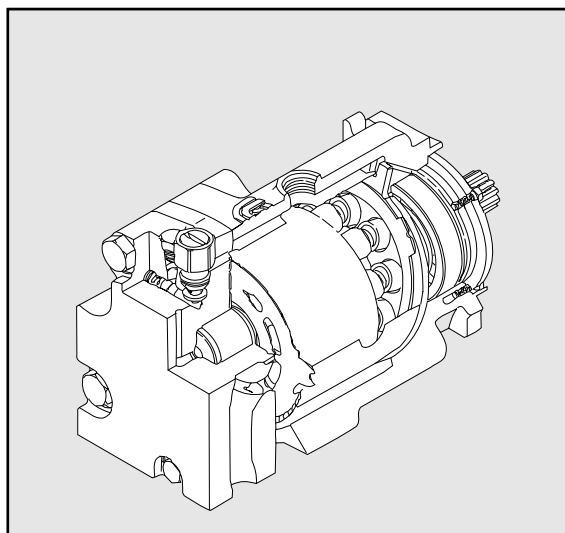
For Technical Information on Series 90 pumps and motors, refer to BLN-10029 and BLN-10030.

For Fluid Quality Requirements, refer to bulletin BLN-9887, or Publication SDF (Id. No. 697581).

Sauer-Sundstrand provides a complete repair service for its products. Contact any Sauer-Sundstrand Authorized Service Center for details. Sauer-Sundstrand Authorized Service Center locations are listed in BLN-2-40527, or Publication SAW (Id. No. 698266).



90000015

Series 90 Variable Displacement Pump

90000016

Series 90 Fixed Displacement Motor



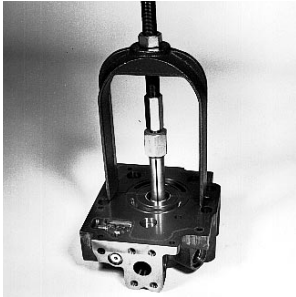
Axial Piston Pumps and Motors

Series 90

Safety Precautions

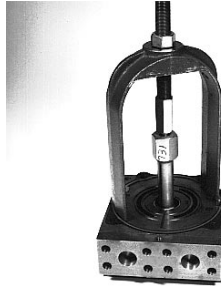
- | | |
|---|---|
| <ul style="list-style-type: none">● When Series 90 units are used in vehicular hydrostatic drive systems, the loss of hydrostatic drive line power in any mode of operation may cause a loss of hydrostatic braking capacity. A braking system, redundant to the hydrostatic transmission must, therefore, be provided which is adequate to stop and/or hold the system should the condition develop.● Certain service procedures may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing them in order to prevent injury to the technician and bystanders. | <ul style="list-style-type: none">● Use caution when dealing with hydraulic fluid under pressure. Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury. This fluid may also be hot enough to burn. Serious infection or reactions can develop if proper medical treatment is not administered immediately.● Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.● Always test Series 90 units prior to reinstalling in order to verify correct function of controls and other systems. |
|---|---|

Tool Information



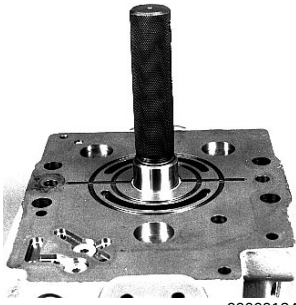
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Fig. 20-1 - Removing Journal Bearing (PV)



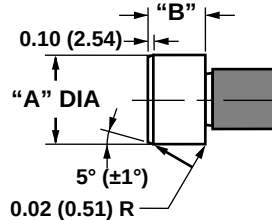
90000170

Fig. 20-2 - Removing Journal Bearing (MF/MV)



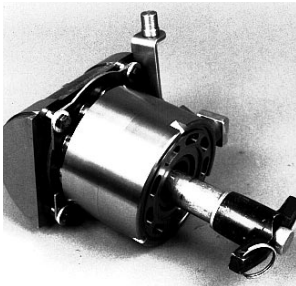
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Fig. 20-3 - Sizing Journal Bearing in End Cap (PV)



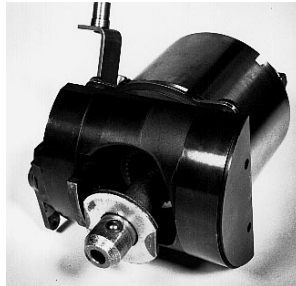
90000188

Fig. 20-4 - Journal Bearing Sizing Arbor Dimensions



90000145

Fig. 20-5 - Install Assembly Tool (PV)



90000215

Fig. 20-6 - Install Flat Washer on Assembly Tool

Certain tools are helpful in disassembling and assembling Series 90 pumps and motors which are not normally included in the typical mechanic's set of tools. These include:

An internal puller for removing the shaft journal bearing from the end cap. (Example: Snap-On Tools Puller Set CG45)

Sizing arbors for the end cap shaft journal bearing (Sauer-Sundstrand part number 9510667-XXXX).

CAUTION

The pump or motor shaft must NOT be used to size the bearing. Inadequate clearance between the shaft and bearing will result in inadequate lubrication and shortened bearing life.

Dimensions for the sizing arbors are shown in the accompanying figure and table. The arbors are made of AISI 4140 steel. A 4 to 8 RMS microfinish and a hardness of 50 to 57 Rc is required on Diameter "A."

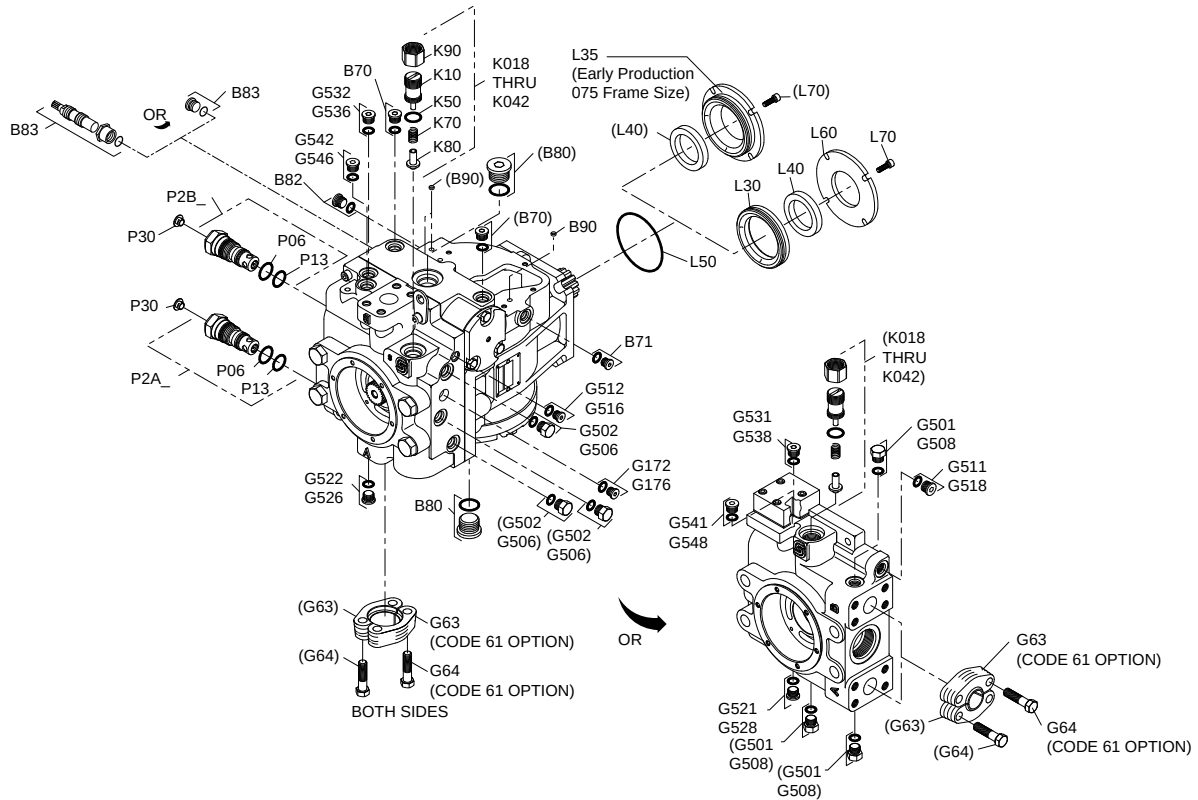
Frame Size	Diameter "A" (±0.0001 in. or ±0.00254 mm)	Dimension "B" Minimum
030	25.300 mm	22.0 mm
042	28.010 mm	30.5 mm
055	1.1818 in.	1.00 in.
075	1.3785 in.	1.20 in.
100	1.5000 in.	1.27 in.
130	44.984 mm	40.5 mm

A tool to aid in holding and installing the assembled cylinder block and swashplate into the variable pump housing may be made from a positive lock, quick release pin and a large flat washer (1 inch inside diameter with clearance flats ground on the outside diameter). The 1 inch diameter pin is defined by military specification MS 17985 C 16 60, and is available from a number of sources. These include:

QRP, Incorporated
 Reach Road & North Drive, PO Box T3572
 Williamsport, PA 17701-0572
 Telephone: (717) 322-8060
 Carr Lane Manufacturing Co.
 4200 Carr Lane Court, PO Box 13149
 St. Louis, MO 63119
 Telephone: (314) 647-6200
 Lockwell Products
 Division of The Hartwell Corporation
 900- T South Richfield Road
 Placentia, CA 92670
 Telephone: (714) 579-4425

Exploded View of the Variable Displacement Pump

The following information is for general parts identification ONLY. Refer to the applicable Service Parts List when ordering service parts.



Model
Number
Serial
Number

SAUER SUNDSTRAND	
Ames, Iowa, U.S.A.	Neumünster, Germany
Model Code	Typ
90L055	EA 1 N
6 S 3 C6 C 03	
HNN 35 35 24	
Model No.	Ident Nr
94 - 2029	
Serial No.	Fabr Nr
A - 88 - 26 - 67890	
MADE IN U.S.A.	

Place of Manufacture

Name Plate (U.S.A. Production)

Model
Number
Serial
Number

SAUER SUNDSTRAND	
Ames, Iowa, U.S.A.	Neumünster, Germany
Model Code	Typ
90L055	EA 1 N
6 S 3 C6 C 03	
HNN 35 35 24	
Model No.	Ident Nr
	687459
Serial No.	Fabr Nr
N - 88 - 26 - 67890	
MADE IN GERMANY	

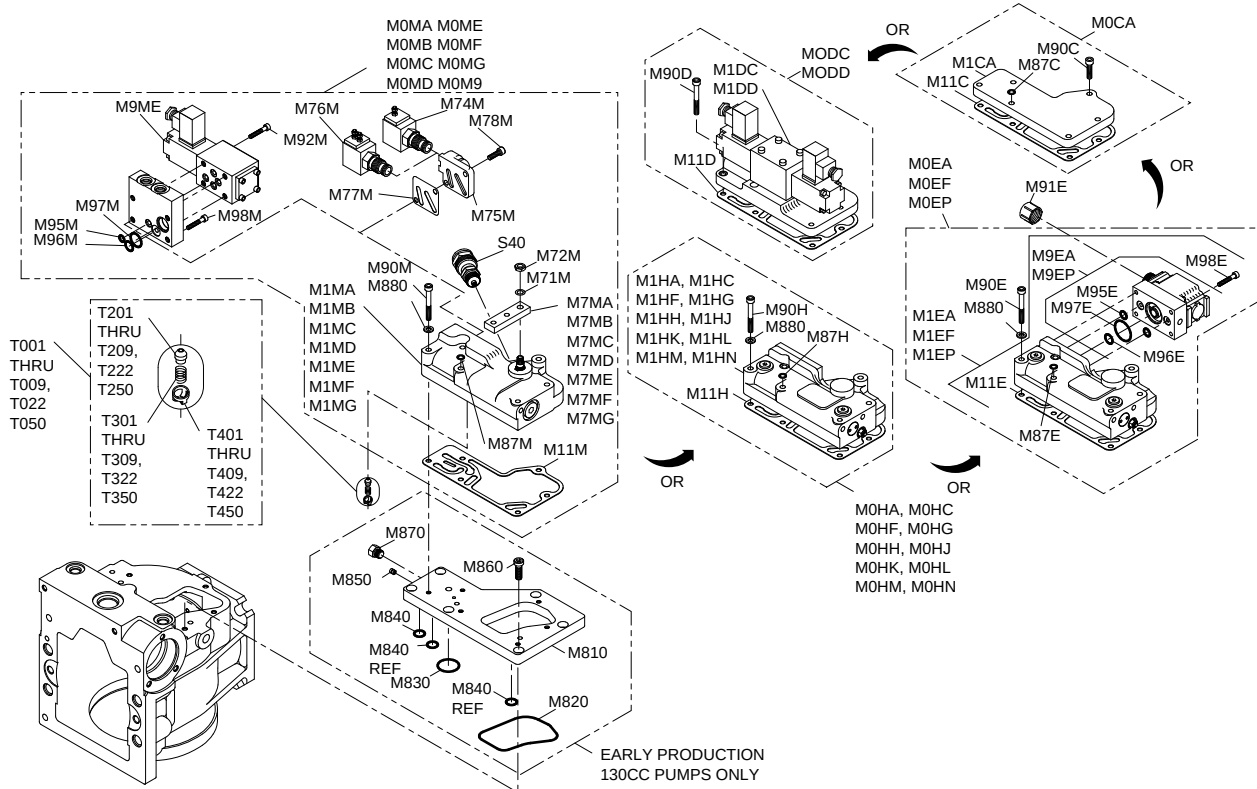
Place of Manufacture

Name Plate (German Production)

Axial Piston Pumps and Motors

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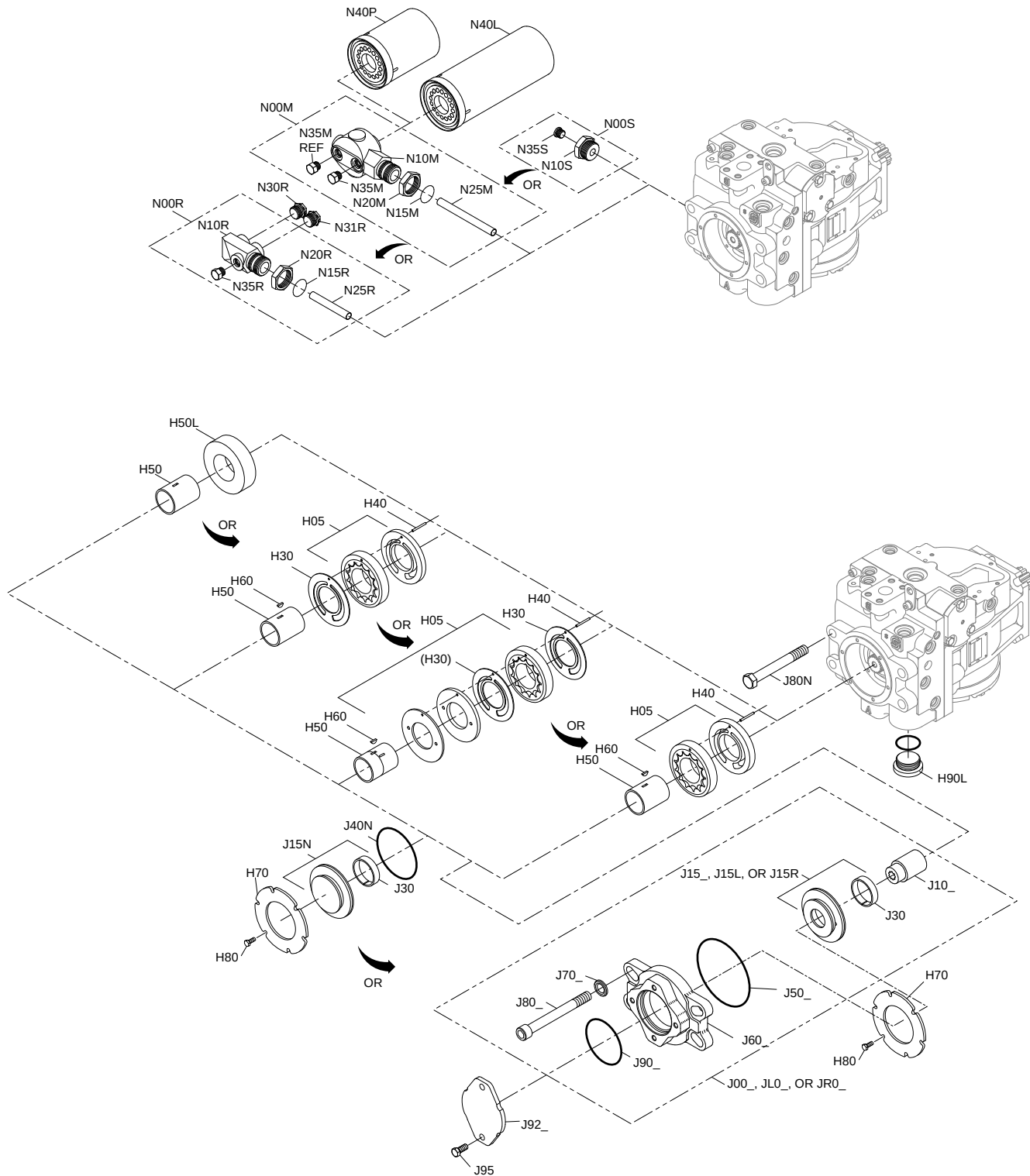
Exploded View of the Variable Displacement Pump (Continued)



Axial Piston Pumps and Motors

Series 90

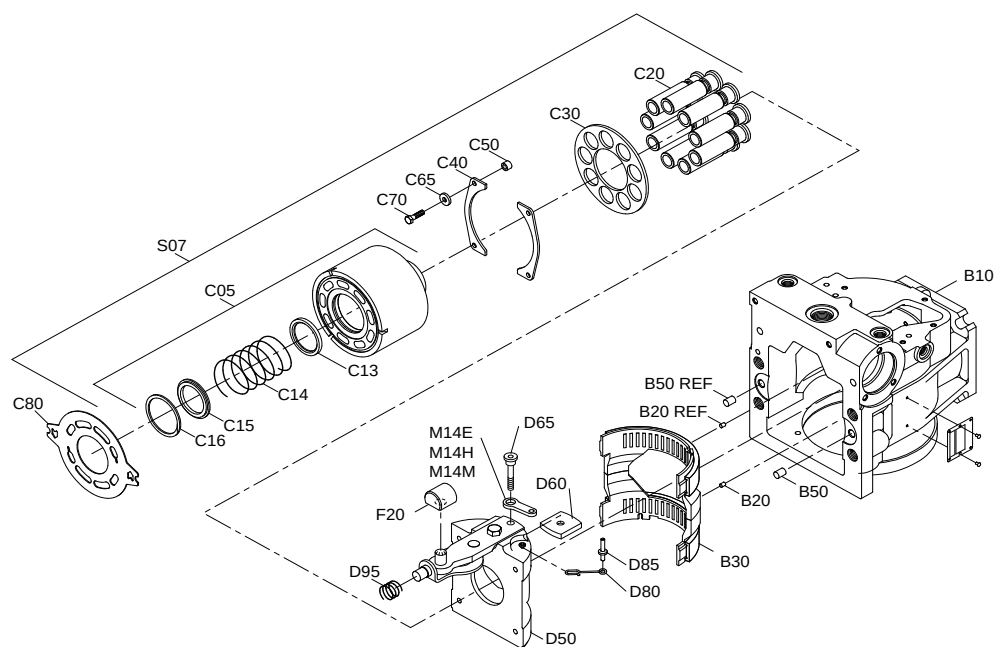
Exploded View of the Variable Displacement Pump (Continued)



Axial Piston Pumps and Motors

Series 90

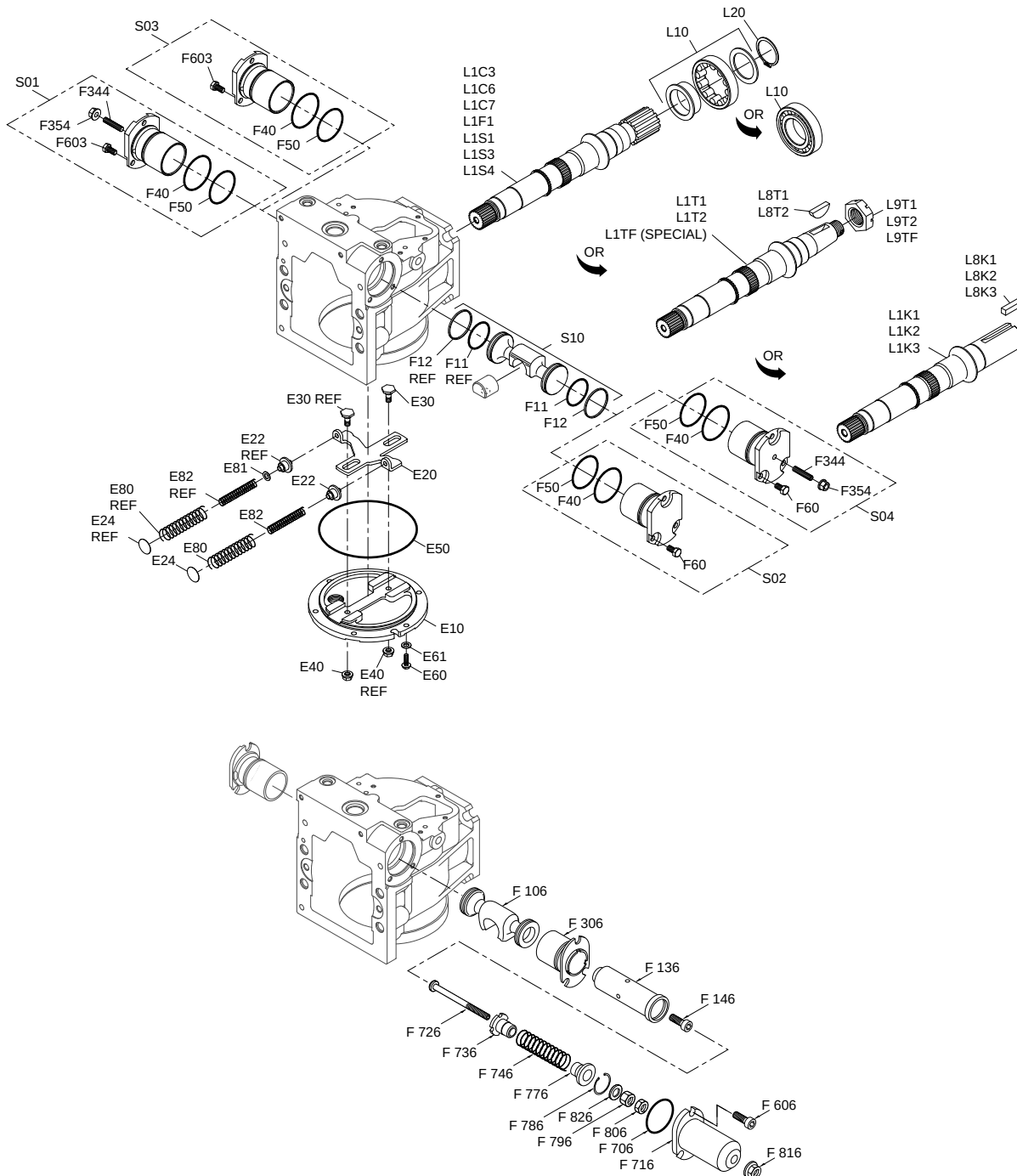
Exploded View of the Variable Displacement Pump (Continued)



Axial Piston Pumps and Motors

Series 90

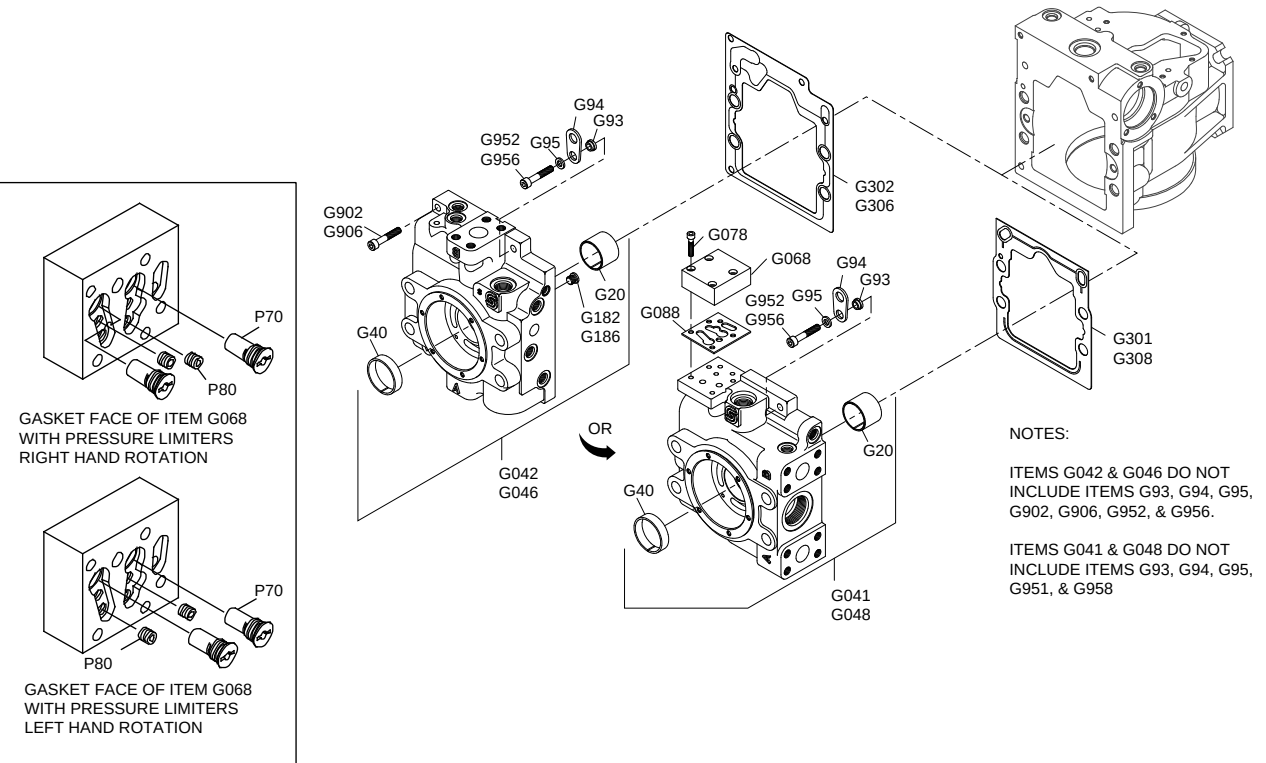
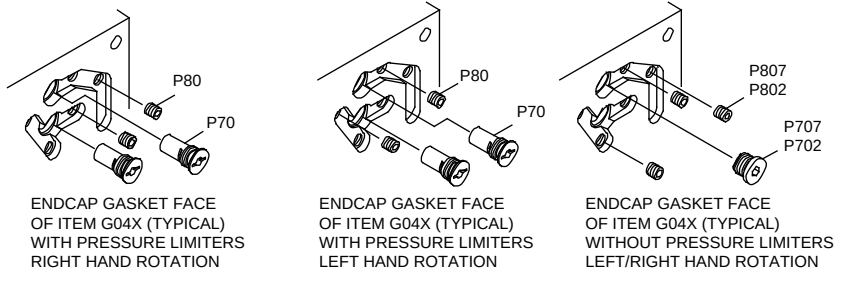
Exploded View of the Variable Displacement Pump (Continued)



Axial Piston Pumps and Motors

Series 90

Exploded View of the Variable Displacement Pump (Continued)



Axial Piston Pumps and Motors

Series 90

Exploded View of the Variable Displacement Pump (Continued)

Item	Description	Qty	Item	Description	Qty
B10	VARIABLE HOUSING	1	F736	SPRING GUIDE (INNER)	1
B20	PIN	2	F746	SPRING	1
B30	BEARING	1	F776	SPRING GUIDE (OUTER)	1
B50	PIN	2	F786	RETAINING RING	1
B70	PLUG	2	F796	NUT	1
B80	PLUG	1	F806	NUT - LOCK	1
B90	CONTROL FILTER SCREEN	3	F816	NUT - SEAL LOCK	1
C05	CYLINDER BLOCK ASSY	1	F826	WASHER - FLAT	4
C13	SPRING SEAT	1			
C14	CYLINDER BLOCK SPRING	1	G048	END CAP - TWIN PORTS	1
C15	SPRING RETAINER	1	G046	END CAP - AXIAL PORTS	1
C16	RETAINING RING	1	G20	JOURNAL BEARING	1
C20	PISTON	9	G40	BUSHING	1
C30	SLIPPER GUIDE	1	G61	PORT SHIPPING COVER GASKET	2
C40	SLIPPER GUIDE BEARING	1	G62	PORT SHIPPING COVER	2
C50	SPACER	4	G63	SPLIT CLAMP	4
C65	WASHER	4	G64	SCREW - SHIPPING COVER	4
C70	SCREW	4	G068	VALVE HOUSING ASSY	1
C80	VALVE PLATE		G078	SCREW	4
D50	SWASHPLATE ASSY	1	G088	GASKET	1
D80	CAGE LOCATOR LINK	1	G93	SPACER	1
D85	PIN	1	G94	LIFTING BRACKET	1
D95	SPRING	1	G95	WASHER	1
E10	SIDE COVER	1	G306	END CAP GASKET	1
E20	LEVELER	1	G308	END CAP GASKET	1
E22	SPRING SEAT	2	G506	PLUG	3
E24	SHIM	2	G508	PLUG	3
E30	GUIDE POST	2	G526	PLUG	1
E40	NUT	2	G546	PLUG	1
E50	O RING	1	G906	SCREW	1
E60	SCREW	6	G956	SCREW	1
E61	WASHER - FLAT	6	G958	SCREW	1
E70	PLUG	1			
E80	SPRING	2	H05B-H	KIT - CHARGE PUMP	1
F11	O RING	2	H05L	SPACER (NO CHARGE PUMP)	1
F12	PISTON RING	2	H30	PORT PLATE	2
F20	SLIDER BLOCK	1	H40	PIN	1
			H50	CHARGE PUMP SHAFT	1
F003	SERVO SLEEVE KIT - NO LIMITER	2	H60	KEY	1
F004	SERVO SLEEVE KIT - ADJUSTABLE	2	H70	RETAINING PLATE	1
F40	O RING	2	H80	SCREW	6
F50	O RING	2	H90	PLASTIC PLUG	1
F60	SCREW	6	H90L	PLUG	1
F344	SCREW	2			
F354	NUT	2	J00A	AUX. MTG. 'A' FLANGE	1
			J00B	AUX. MTG. 'B' FLANGE	1
F106	SERVO PISTON (FBA)	1	J00C	AUX. MTG. 'C' FLANGE	1
F136	NEUTRAL SPRING CANNISTER (FBA)	1	J00D	AUX. MTG. 'D' FLANGE	1
F146	SCREW	1	J00T	AUX. MTG. 'A' FLANGE (11T)	1
F306	SERVO SLEEVE (FBA)	1	J00V	AUX. MTG. 'B-B' FLANGE	1
F606	SCREW	3	J00N	AUX. MTG. FLANGE - NONE	1
F706	O-RING	1	J10A-V	COUPLING	1
F716	NEUTRAL SPRING COVER (FBA)	1	J15	CHARGE PUMP COVER ASSY	1
F726	SCREW	1	J15N	CHARGE PUMP COVER ASSY	1

Axial Piston Pumps and Motors

Series 90

Exploded View of the Variable Displacement Pump (Continued)

Item	Description	Qty	Item	Description	Qty
J30	BUSHING	1	M90C	SCREW	6
J40A-V	O RING	1	M14	FEEDBACK LINK	1
J50A-V	O RING	1			
J60A/T	FLANGE ADAPTOR	1	M0DC	CONTROL KIT 3 POS F-N-R 12V	1
J60B/V	FLANGE ADAPTOR	1	M0DD	CONTROL KIT 3 POS F-N-R 24V	1
J60C	FLANGE ADAPTOR	1	M1DC	CONTROL 3 POS F-N-R 12V	1
J60D	FLANGE ADAPTOR	1	M1DD	CONTROL 3 POS F-N-R 24V	1
J70A-V	WASHER	4	M80	CONTROL GASKET	1
J80A-V	SCREW	4	M87D	WASHER, SEAL (042)	1
J80N	SCREW	4	M90D	SCREW	6
J90A-V	O RING	1			
J92A-V	COVER PLATE	1	M0EA	EDC KIT W/MS CONNECTOR	1
J95A-V	SCREW	2/4	M0EP	EDC KIT W/PACKARD CONNECTOR	1
			M1EA	EDC W/MS CONNECTOR	1
K000	ADJ. CHARGE RELIEF KIT	1	M1EP	EDC W/PACKARD CONNECTOR	1
K10	PLUG ASSY	1	M9EA	PCP TYPE 3 OIL FILLED (MS)	1
K50	O RING	1	M9EA	PCP TYPE 3 OIL FILLED (PACKARD)	1
K70	SPRING	1	M80	CONTROL GASKET	1
K80	POPPET	1	M87E	WASHER, SEAL (042)	1
K90	NUT	1	M90E	SCREW	6
			M91E	PLASTIC CAP (MS)	1
L10	ROLLER BEARING	1	M95E	O RING	2
L20	RETAINING RING	1	M96E	O RING	1
L35	SEAL CARRIER	1	M97E	O RING	1
L40	LIP SEAL	1	M98E	SCREW	4
L50	O RING	1	M14	FEEDBACK LINK	1
L70	SCREW	3			
			M0HA	HDC KIT	1
L1C3	SHAFT - PV, SPLINED	1	M0HC	HDC KIT	1
L1C6	SHAFT - PV, SPLINED	1	M1HA	HDC	1
L1C7	SHAFT - PV, SPLINED	1	M1HC	HDC	1
L1C8	SHAFT - PV, SPLINED	1	M80	CONTROL GASKET	1
L1F1	SHAFT - PV, SPLINED	1	M90H	SCREW	6
L1K1	SHAFT - PV, STRAIGHT KEY	1	M14	FEEDBACK LINK	1
L1K2	SHAFT - PV, STRAIGHT KEY	1			
L1K3	SHAFT - PV, STRAIGHT KEY	1	M0MA	MDC W/O NEUTRAL START SWITCH	1
L1S1	SHAFT - PV, SPLINED	1	M7M	CONTROL HANDLE	1
L1T1	SHAFT PV, TAPERED	1	M71M	WASHER	1
L1T2	SHAFT PV, TAPERED	1	M72M	NUT	1
L1T3	SHAFT PV, TAPERED	1	M80	CONTROL GASKET	1
L8	KEY	1	M90M	SCREW	6
L9	SLOTTED NUT	1	M14	FEEDBACK LINK	1
M0AC	ADAPTER PLATE - FBA CONTROL	1	M0MB	MDC W/NEUTRAL START SWITCH	1
M77A	ADAPTER PLATE - FBA	1	M7M	CONTROL HANDLE	1
M78A	SCREW	6	M71M	WASHER	1
M90A	SCREW	6	M72M	NUT	1
M92A	SCREW	2	M80	CONTROL GASKET	1
M98A	SCREW	1	M90M	SCREW	6
			S40	NEUTRAL START SWITCH KIT	1
M0CA	CONTROL - COVER PLATE KIT	1	M14	FEEDBACK LINK	1
M1C	COVER PLATE	1			
M80	CONTROL GASKET	1	M0MC	MDC W/SOL. VALVE	1
M87C	WASHER, SEAL (042)	1	M7M	CONTROL HANDLE	1

Axial Piston Pumps and Motors

Series 90

Exploded View of the Variable Displacement Pump (Continued)

Item	Description	Qty	Item	Description	Qty
M71M	WASHER	1	P13	O RING	2
M72M	NUT	1	P30	PLASTIC PLUG	2
M74M	SOLENOID VALVE	1	P70	CHECK VALVE	2
M75M	CONTROL MANIFOLD	1	P702	PLUG	1
M77M	MANIFOLD GASKET	1	P80	SPECIAL PLUG	2
M78M	SCREW	2	P802	SPECIAL PLUG	3
M80	CONTROL GASKET	1	S10	SERVO PISTON KIT	1
M90M	SCREW	6	F11	O RING	2
M14	FEEDBACK LINK	1	F12	PISTON RING	2
M0MD	MDC W/SOL. VALVE, NSS	1			
M7M	CONTROL HANDLE	1	T001-9	CONTROL ORIFICE KIT	1
M71M	WASHER	1	T201	ORIFICED CHECK VALVE	1
M72M	NUT	1	T301	SPRING	1
M75M	CONTROL MANIFOLD	1	T401	SPRING RETAINER	1
M76M	SOLENOID VALVE	1	T560-5	CONTROL ORIFICE (FBA)	1
M77M	MANIFOLD GASKET	1	T660-5	CONTROL ORIFICE (FBA)	1
M78M	SCREW	2			
M80	CONTROL GASKET	1	S07	CYL. BLOCK KIT W/ PISTONS	1
M90M	SCREW	6	C20	PISTON	9
S40	NEUTRAL START SWITCH KIT	1	C80	PUMP VALVE PLATE	1
M14	FEEDBACK LINK	1	S30	OVERHAUL SEAL KIT	1
			C70	SCREW	4
M810	ADAPTER PLATE - CONTROL (130 CC)	1	E40	NUT	2
M820	O-RING (130 CC)	1	E50	O RING	1
M830	O-RING (130 CC)	1	E60	SCREW	6
M840	O-RING (130 CC)	2	F11	O RING	2
M850	PLUG (130 CC)	1	F12	PISTON RING	2
M860	SCREW (130 CC)	6	F40	O RING	2
M870	PLUG (130 CC)	1	F50	O RING	2
			G088	GASKET	1
N00M	FILTRATION MANIFOLD KIT (INT)	1	G306	END CAP GASKET - AXIAL PORTS	1
N10M	MANIFOLD	1	G308	END CAP GASKET - TWIN PORTS	1
N15M	O RING	2	J40A	O RING	1
N20M	NUT	1	J50A	O RING	1
N25M	TUBE	1	J90A	O RING	1
N30M	PLUG	2	J90B	O RING	1
N40L	FILTER	1	J90C	O RING	1
N40P	FILTER	1	K50	O RING	1
			L40	LIP SEAL	1
N00R	FILTRATION MANIFOLD KIT (RMT)	1	L50	O RING	1
N10R	MANIFOLD	1	M77M	MANIFOLD GASKET	1
N15R	O RING	1	M80	CONTROL GASKET	1
N20R	NUT	1	M95E	O RING	2
N25R	TUBE	1	M96E	O RING	1
N30R	PLASTIC PLUG	2	M97E	O RING	1
N00R	PLUG	1	N15	O RING	1
			P6	O RING	2
N10S	REDUCER FITTING (SUCTION FLT)	1	P13	O RING	2
N30S	PLUG	1			
P2A	MULTI-FUNCTION VALVE ASSY	1			
P2B	MULTI-FUNCTION VALVE ASSY	1			
P6	O RING	2			

Axial Piston Pumps and Motors

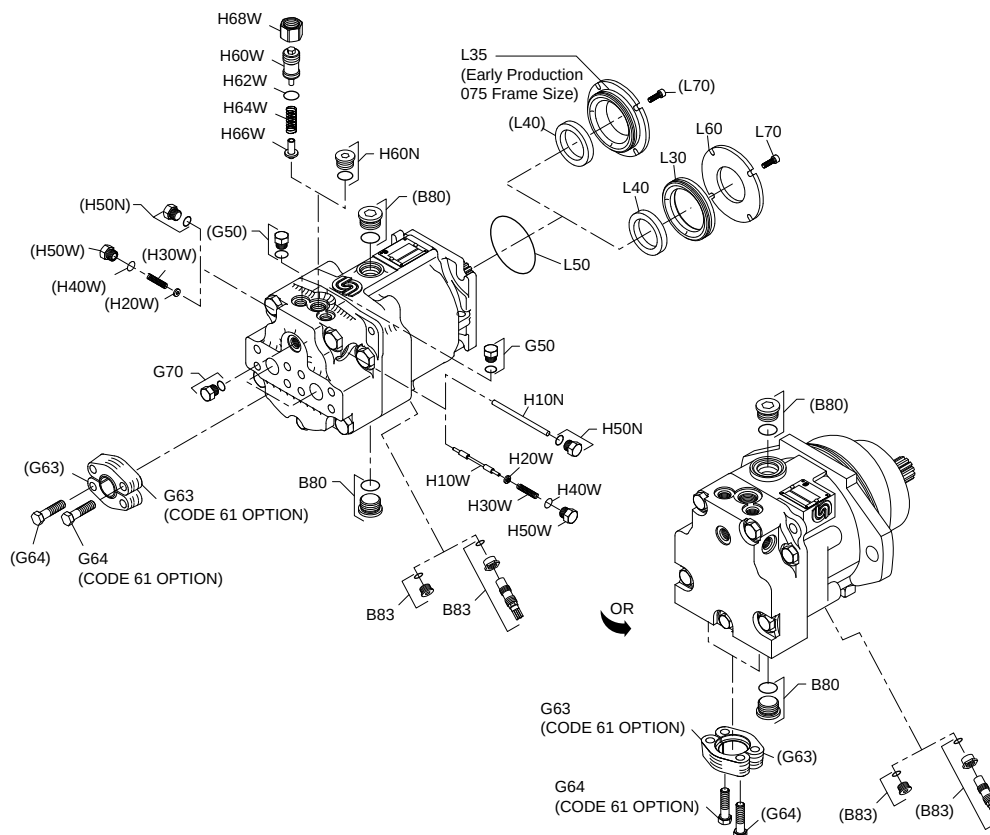
Series 90

Exploded View of the Variable Displacement Pump (Continued)

Item	Description	Qty	Item	Description	Qty
W001	VALVE BLOCK (FBA)	1	W552	PLUG (HYD INCHING)	1
W002	PLUG	1	W553	O-RING (HYD INCHING)	1
W003	PLUG	1	W554	O-RING (HYD INCHING)	1
W004	O-RING	1	W555	SPOOL (HYD INCHING)	1
W005	O-RING	1	W556	SPRING SEAT - INNER (HYD INCHING)	1
W006	STARTING THROTTLE (FBA)	1	W557	SPRING (HYD INCHING)	1
W007	NUT - SEAL LOCK	1	W558	SPRING WASHERS (HYD INCHING)	1
W008	PLUG - EXPANDER	4	W559	SPRING SEAT - OUTER (HYD INCHING)	1
W009	PLUG ASSY	1	W560	O-RING (HYD INCHING)	1
W010	NUT	1	W561	PLUG - THREADED (HYD INCHING)	1
W011	O RING	1	W562	NUT - SEAL LOCK (HYD INCHING)	1
W012	POPPET	1	W563	SCREW - ADJUSTING (HYD INCHING)	1
W013	SPRING	1	W70A	3 POS / 4 WAY VALVE (FBA)	1
W014	SEAT	1	W701	FNR VALVE (ELECTRICAL)	1
W015	ORIFICE	1	W702	SCREW	4
W10A	THERMOVALVE (FBA)	1	W74A	3 POS / 4 WAY VALVE W/INCH (FBA)	1
W121	PLATE (FBA)	1	W740	FNR VALVE	1
W122	SCREW	4	W701	FNR VALVE (ELECTRICAL)	1
W21-26A	MAIN ORIFICE (FBA)	1	W741	SCREW	4
W30A	PRESSURE RELIEF VALVE (FBA)	1	W750	INCH VALVE (ROTARY)	1
W302	O-RING	1	W751	VALVE BLOCK	1
W304	NUT - SEAL LOCK	1	W752	PLUG	1
W41A	THROTTLE OR PRESS VALVE (FBA)	1	W753	VALVE SPOOL	1
W402	O-RING	1	W754	RING - RETAINING	2
W414	NUT - SEAL LOCK	1	W755	RETAINER	2
W501	SCREW (LESS INCHING)	2	W756	O-RING	2
W502	PLATE (LESS INCHING)	1	W757	GASKET	1
W503	O-RING (LESS INCHING)	1			
W504	PLUG (LESS INCHING)	1			
W505	SPOOL (LESS INCHING)	1			
W506	PLUG (LESS INCHING)	1			
W521	SCREW (MECH INCHING)	2			
W522	PLATE (MECH INCHING)	1			
W523	O-RING (MECH INCHING)	1			
W524	PLUG (MECH INCHING)	1			
W525	SPOOL (MECH INCHING)	1			
W526	WASHER - FLAT (MECH INCHING)	1			
W527	O-RING (MECH INCHING)	1			
W528	O-RING (MECH INCHING)	1			
W529	PLUG (MECH INCHING)	1			
W541	CYLINDER ASSY (HYD INCHING)	1			
W542	SCREW (HYD INCHING)	2			
W543	PISTON CYLINDER (HYD INCHING)	1			
W544	PISTON (HYD INCHING)	1			
W545	SEAL - PISTON (HYD INCHING)	1			
W546	SEAL RETAINER (HYD INCHING)	1			
W547	PLUG (HYD INCHING)	1			
W548	BLEED SCREW (HYD INCHING)	1			
W550	PIN (HYD INCHING)	1			
W551	O-RING (HYD INCHING)	1			

Exploded View of the Fixed Displacement Motor

The following information is for general parts identification ONLY. Refer to the applicable Service Parts List when ordering service parts.



SAUER SUNDSTRAND	
Ames, Iowa, U.S.A.	Neumünster, Germany
Model Code	Typ
90M055	NC 0 N
8 N 0 C6 W 00	
NNN 00 00 24	
Model No.	Ident Nr
94 – 2029	
Serial No.	Fabr Nr
A – 91 – 26 – 67890	
MADE IN U.S.A.	
Place of Manufacture	

Name Plate (U.S.A. Production)

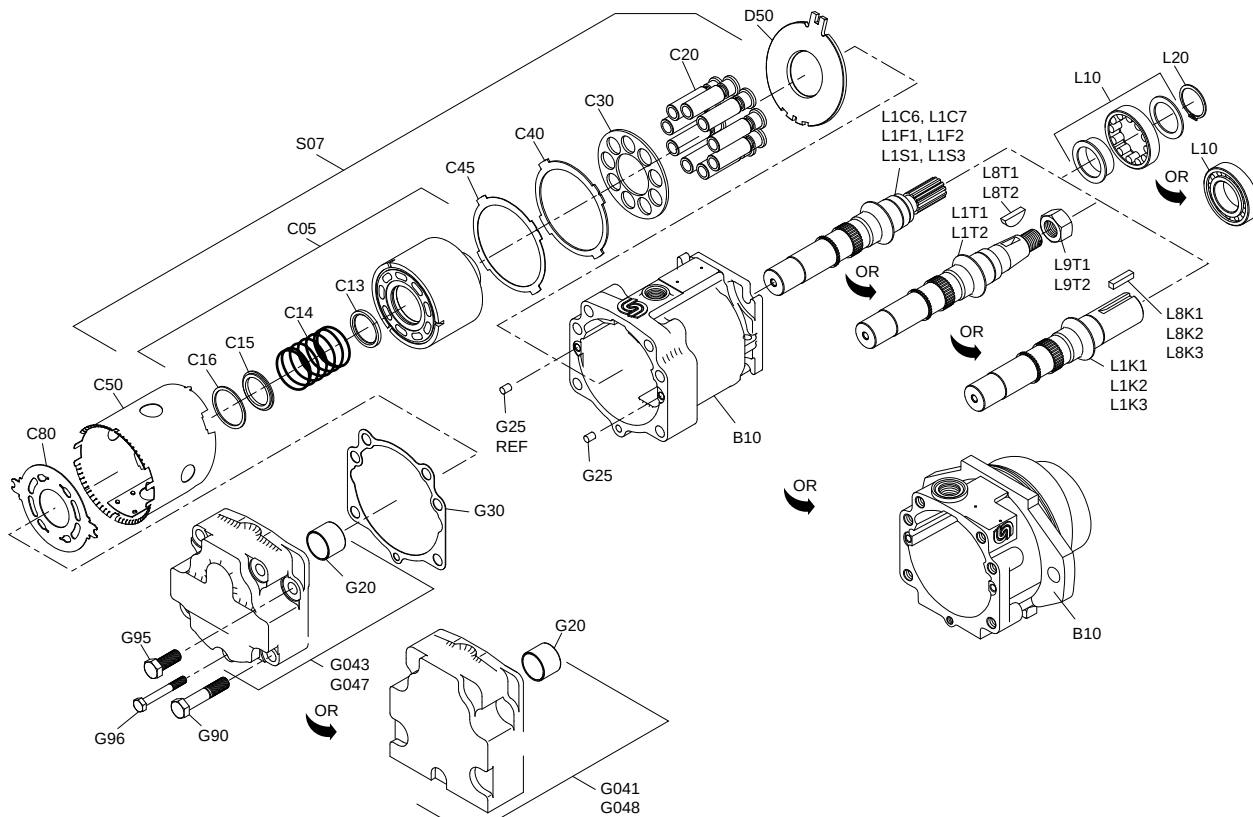
SAUER SUNDSTRAND	
Ames, Iowa, U.S.A.	Neumünster, Germany
Model Code	Typ
90M055	NC 0 N
8 N 0 C6 W 00	
NNN 00 00 24	
Model No.	Ident Nr
312918	
Serial No.	Fabr Nr
N – 91 – 26 – 67890	
MADE IN GERMANY	
Place of Manufacture	

Name Plate (German Production)

Axial Piston Pumps and Motors

Series 90

Exploded View of the Fixed Displacement Motor (Continued)



Axial Piston Pumps and Motors

Series 90

Exploded View of the Fixed Displacement Motor (Continued)

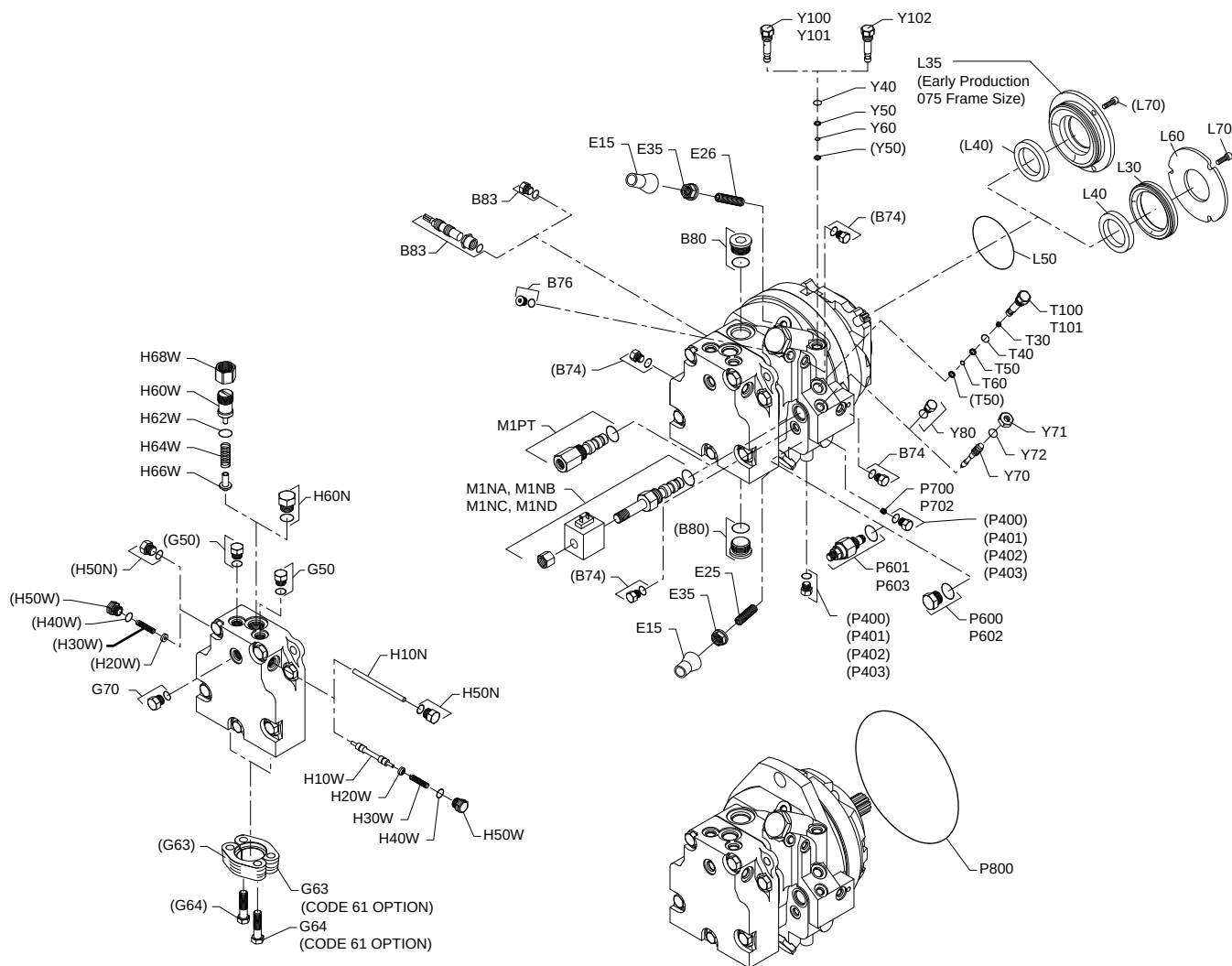
Item	Description	Qty	Item	Description	Qty
B10	FIXED HOUSING	1	L10	ROLLER BEARING	1
B80	PLUG	2	L20	RETAINING RING	1
C05	CYLINDER BLOCK ASSY	1	L35	SEAL CARRIER	1
C13	SPRING SEAT	1	L40	LIP SEAL	1
C14	SPRING	1	L50	O RING	1
C15	SPRING RETAINER	1	L70	METRIC SCREW	3
C16	RETAINING RING	1			
C20	SEE 'W' GROUP FOR PISTONS		L1C6	SHAFT - SPLINED	1
C30	SLIPPER GUIDE	1	L1C7	SHAFT - SPLINED	1
C40	SLIPPER GUIDE RETAINER	1	L1K2	SHAFT - STRAIGHT KEY	1
C45	SLIPPER GUIDE RETAINER SHIM	1	L8	KEY	1
C50	HOLD DOWN TUBE	1	L1S1	SHAFT - SPLINED	1
C80	VALVE PLATE	1	L1T2	SHAFT - TAPERED	1
D50	THRUST PLATE	1	L8	KEY	1
G25	PIN	2	L9	SLOTTED NUT	1
G30	END CAP GASKET	1			
G50	PLUG	2	S07	CYLINDER BLOCK KIT W/PISTONS	1
G70	PLUG	1	C20	PISTON	9
G90	SCREW	4			
G95	SCREW	2	S30	OVERHAUL REPAIR KIT	1
G96	SCREW	1	G30	END CAP GASKET	1
			H40W	O RING	2
G047	END CAP - AXIAL PORTS	1	K50	O RING	1
G048	END CAP - TWIN PORTS	1	L40	LIP SEAL	1
G20	JOURNAL BEARING	1	L50	O RING	1
G61	PORT SHIPPING COVER GASKET	2			
G62	PORT SHIPPING COVER	2			
G63	SPLIT CLAMP	4			
G64	SCREW - SHIPPING COVER	4			
H10N	LOOP FLUSHING SPOOL - DEFEAT	1			
H50N	PLUG	2			
H10W	SHUTTLE VALVE SPOOL	1			
H20W	SPECIAL WASHER	2			
H30W	SPRING	2			
H40W	O RING	2			
H50W	SPECIAL PLUG	2			
K000	PLUG	1			
K10	PLUG ASSY	1			
K50	O RING	1			
K610	SHIM	A/R			
K70	SPRING	1			
K80	POPPET	1			

Axial Piston Pumps and Motors

Series 90

Exploded View of the Variable Displacement Motor • 055 and 075

The following information is for general parts identification ONLY. Refer to the applicable Service Parts List when ordering service parts.



SAUER SUNDSTRAND	
Ames, Iowa, U.S.A.	Neumünster, Germany
Model Code	Typ
90S055	NB 2 0
8 N 4 S1 W 01	
NNN 01 00 24	
Model No. Ident Nr	
94 - 4002	
A - 91 - 26 - 67890	
Serial No.	Fabr Nr
MADE IN U.S.A.	

Model Code

Model Number

Serial Number

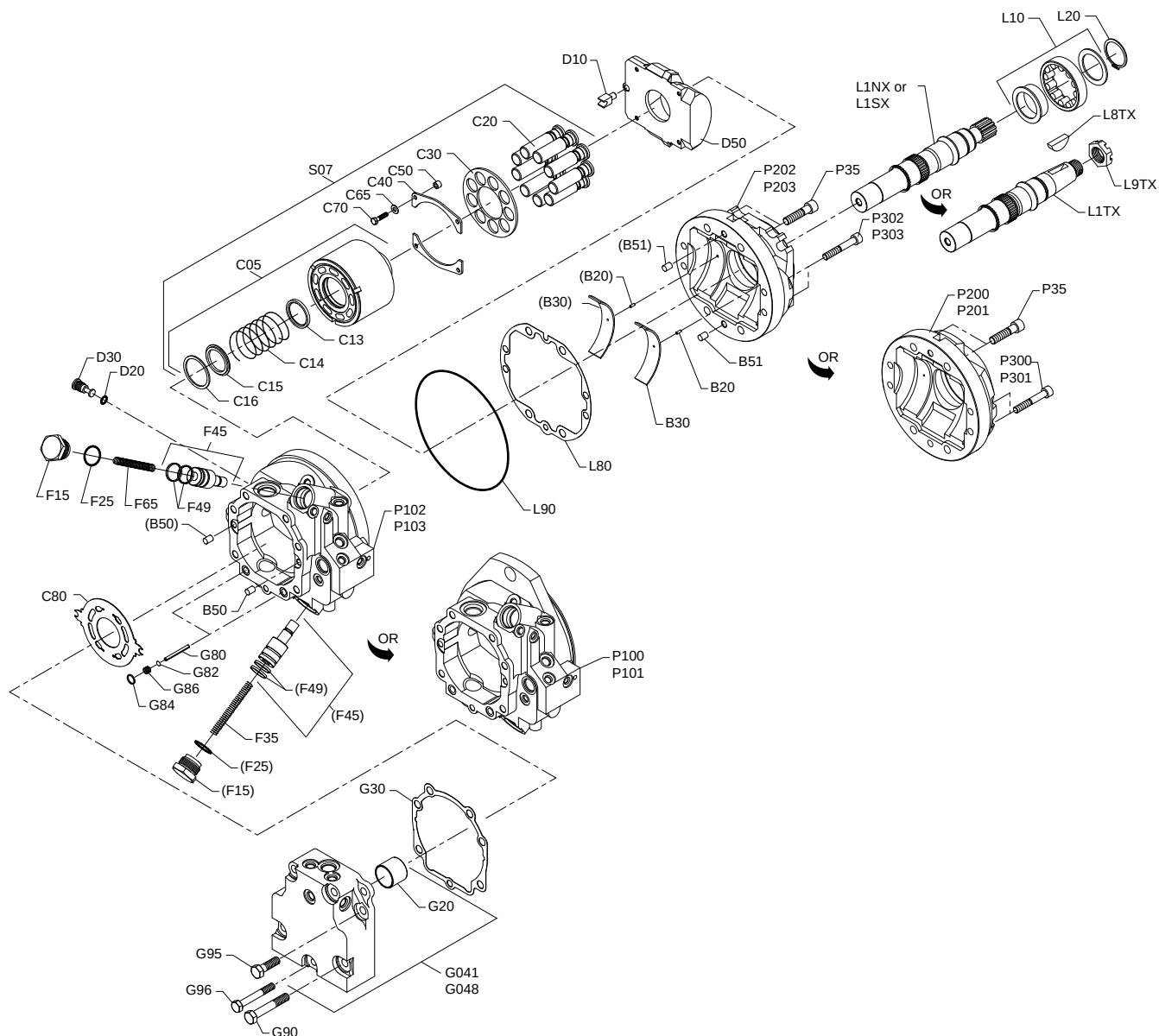
Place of Manufacture

Name Plate (U.S.A. Production)

Axial Piston Pumps and Motors

Series 90

Exploded View of the Variable Displacement Motor • 055 and 075 (Continued)



Axial Piston Pumps and Motors

Series 90

Exploded View of the Variable Displacement Motor • 055 and 075 (Continued)

Item	Description	Qty	Item	Description	Qty
B20	PIN	2	H10W	SHUTTLE VALVE SPOOL	1
B30	CRADLE BEARING	2	H20W	SPRING GUIDE	2
B50	PIN	2	H30W	SPRING	2
B51	PIN	2	H40W	O-RING	2
B74	PLUG	4	H50W	SPECIAL PLUG	2
B76	PLUG	1	H60W	CHARGE RELIEF VALVE PLUG	1
B80	PLUG	2	H62W	O-RING	1
B83	PLUG	1	H64W	SPRING	1
B83	SPEED SENSOR	1	H66W	CHARGE RELIEF POPPET	1
C05	CYLINDER BLOCK ASSEMBLY	1	H68W	LOCK NUT	1
2	SPRING	1			
3	RETAINER	1	L1	SHAFT - SPLINED	1
4	RING	1	L2	SHAFT - TAPERED	1
5	SEAT	2	L8	KEY	1
C20	PISTON ASSEMBLY	9	L9	SLOTTED NUT	1
C30	SLIPPER GUIDE	1			
C40	SLIPPER GUIDE BEARING	2	L10	RETAINING RING	1
C50	SPACER	4	L20	ROLLER BEARING	1
C65	WASHER	4	L35	SEAL CARRIER	1
C70	SCREW	4	L40	LIP SEAL	1
C80	VALVE PLATE	1	L50	O-RING	1
D10	HOLD DOWN ARM	1			
D20	O-RING	1	L70	SCREW	3
D30	HOLD DOWN PIN	1	L80	FRONT COVER GASKET	1
D50	SWASHPLATE	1	L90	O-RING	1
E15	CAP	1			
E25	SET SCREW	1	M1	CONTROL VALVE	1
E35	NUT - SEAL LOCK	1			
F15	SPECIAL PLUG	2	P35	SCREW	4
F25	O-RING	2	P100	VARIABLE MOTOR HOUSING	1
F35	SPRING	1	P200	FRONT COVER	1
F45	SERVO PISTON ASSEMBLY	2	P300	SCREW	4
F49	PISTON SEAL RING	4	P400	PLUG	2
F65	SPRING	1	P600	PLUG	1
G20	JOURNAL BEARING	1	P601	PRESS COMPENSATOR VALVE	1
G30	END CAP GASKET	1	P700	SPECIAL PLUG	1
G41	END CAP	1	S07	CYLINDER BLOCK KIT W/PISTONS	1
G50	PLUG	2			
G61	PORT SHIPPING COVER GASKET	2	T30	FILTER SCREEN	1
G62	PORT SHIPPING COVER	2	T40	O-RING	1
G63	SPLIT FLANGE CLAMP	4	T50	BACK UP RING	2
G64	SHIPPING COVER SCREW	4	T60	O-RING	1
			T100	ORIFICE PLUG	1
G70	PLUG	1			
G80	SPRING PIN	1	Y40	O-RING	1
G82	BALL	1	Y50	BACK UP RING	2
G84	CRUSH RING	1	Y60	O-RING	1
G86	ORIFICE	1	Y100	ORIFICE PLUG	1
G90	SCREW	4			
G95	SCREW	2			
G96	SCREW	1			
H10N	LOOP FLUSHING SPOOL - DEFEAT	1			
H50N	PLUG	2			
H60N	PLUG	1			

Major Repair - Variable Pump

General

The procedures on the following pages are for the complete disassembly and reassembly (Major Repair) of the Series 90 Variable Displacement Pump.

Cleanliness is a primary means of assuring satisfactory hydraulic pump life, on either new or repaired units. Cleaning parts by using a clean solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material.

During the assembly of the Series 90 variable pump, all surfaces which have relative motion between two parts should be coated with a film of clean hydraulic oil. This will assure that these surfaces will be lubricated during start-up.

It is recommended that all O-rings and gaskets be replaced. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly. All gasket sealing surfaces must be cleaned prior to installing new gaskets.

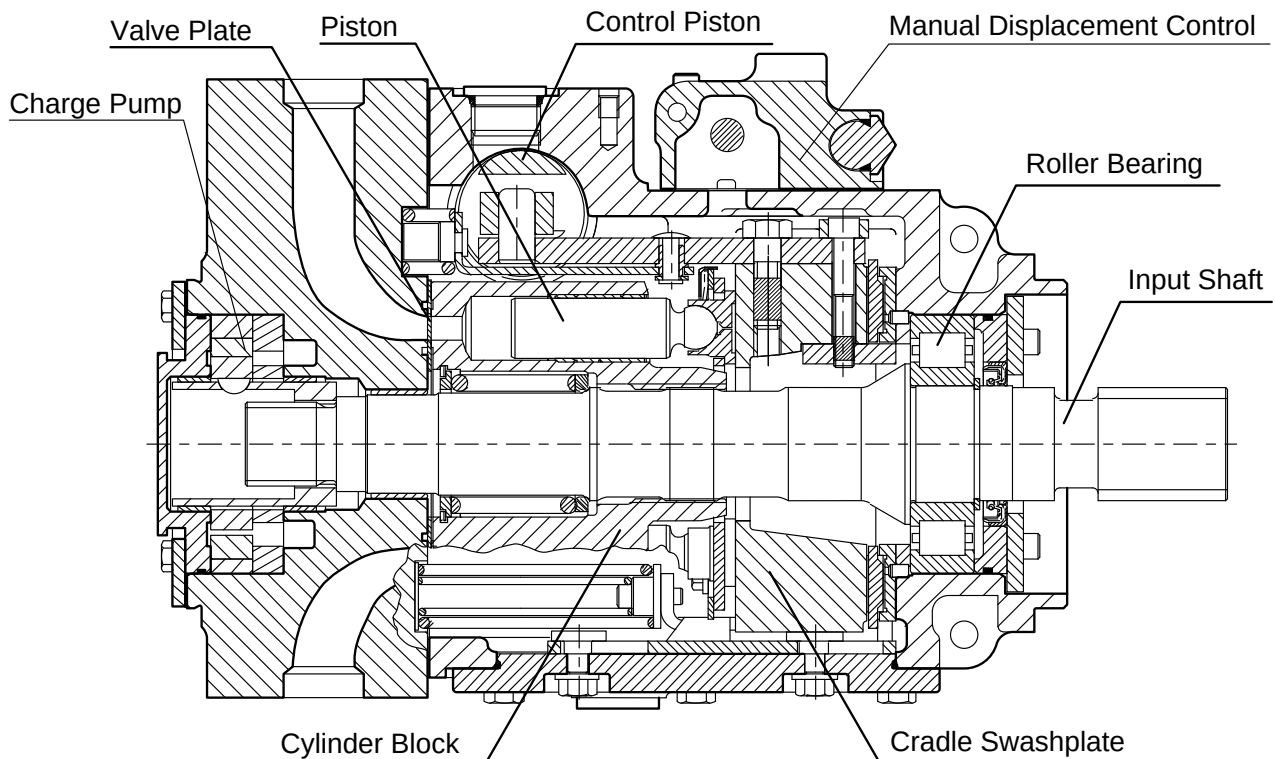


Fig. 61-1 - Cross Section View of Series 90 Variable Displacement Pump

90000189

Major Repair - Variable Pump (Continued)

Disassembly Procedures for Variable Displacement Pump

Prior to performing Major Repairs on the Series 90 Variable Displacement Pump, remove the external components as described in the "Minor Repair" section of the Series 90 Service Manual. These include the following:

- Auxiliary Mounting Pad (Where Applicable)
- Charge Pump
- Control
- Filter Options
- Charge Relief Valve
- Multi-Function Valves
- Shaft Seal

After removal of these components, place the pump on a work surface with the shaft up.

Remove the shaft and bearing assembly from the housing. The bearing outside diameter is a slip fit in the housing bore.

NOTE: If the shaft and bearing stick in the housing, lightly tap the end of the shaft with a soft mallet to free the bearing.

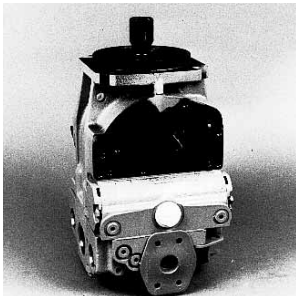
Remove the retaining ring and press the shaft out of the bearing.

Place the pump on the work surface with the end cap up.

NOTE: If the pump was equipped with an auxiliary mounting pad, temporarily reinstall two (2) of the large screws which fasten the end cap to the housing. These screws will hold the end cap against internal spring pressure while the small screws are removed.

Using a 5 mm or 6 mm internal hex wrench or a 10 mm hex wrench, remove the two (2) or three (3) small screws which fasten the end cap to the pump housing.

Using an 8 mm internal hex wrench for 042 pumps, a 19 mm hex wrench for 055 pumps, a 24 mm hex wrench for 075 and 100 pumps, or a 14 mm internal hex wrench for 130 pumps, remove the large screws which fasten the end cap to pump housing.



90000102

Fig. 61-2 - Pump Positioned on End Cap



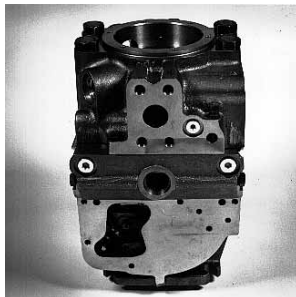
90000103

Fig. 61-3 - Remove Shaft and Bearing



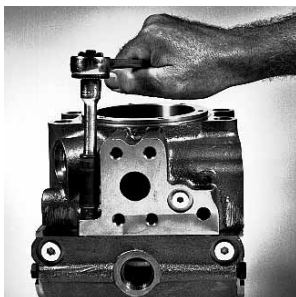
90000192

Fig. 61-4 - Remove Bearing from Shaft



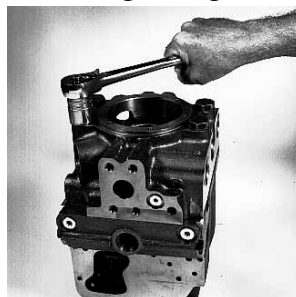
90000104

Fig. 61-5 - Pump Positioned on Mounting Flange



90000193

Fig. 61-6 - Remove Small End Cap Screws



90000105

Fig. 61-7 - Remove Large End Cap Screws

Major Repair - Variable Pump (Continued)

Remove end cap from housing. The alignment pins and valve plate will normally remain with the housing. Remove the end cap gasket. Remove the swashplate leveler spring shims (if installed) from the spring pockets in the end cap.

Remove three (3) springs from pump: the two (2) long swashplate leveler ("T-Bar") springs and the short swashplate hold down spring.

NOTE: Certain units are equipped with dual swashplate leveler springs (an inner spring "nested" inside each of the standard springs).

Remove the alignment pins and valve plate, noting direction of arrows on valve plate.

Mark the orientation of the side cover to the housing.

Straighten the locking tabs (used on earlier production units) and remove the six (6) side cover screws (with flat washers on later production units) using a 10 mm hex wrench for 042 pumps, a 13 mm hex wrench for 055 thru 100 pumps, or a 17 mm hex wrench for 130 pumps.

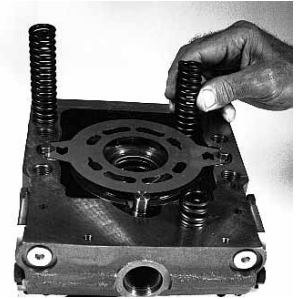
Remove side cover and swashplate leveler ("T-Bar") assembly from housing.

NOTE: Certain units equipped with dual swashplate leveler springs have spacer washers on the leveler spring seats. They may be removed at this time.



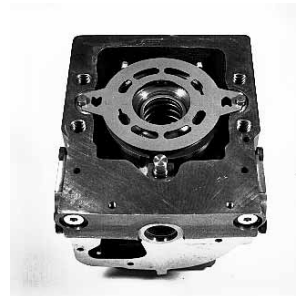
90000107

Fig. 61-8 - Remove End Cap



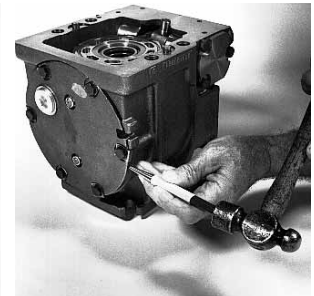
90000108

Fig. 61-9 - Remove Swashplate Springs



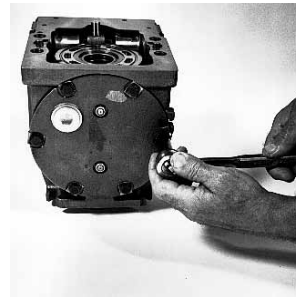
90000109

Fig. 61-10 - Remove Valve Plate



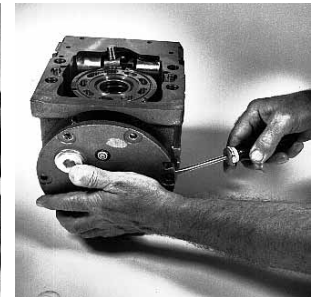
90000110

Fig. 61-11 - Mark Side Cover and Housing



90000111

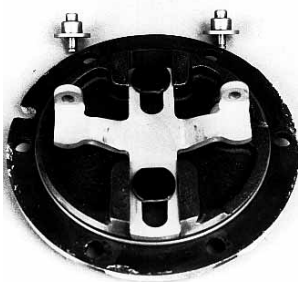
Fig. 61-12 - Remove Side Cover Screws



90000112

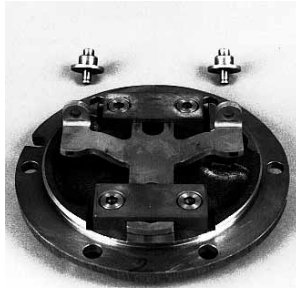
Fig. 61-13 - Remove Side Cover

Major Repair - Variable Pump (Continued)



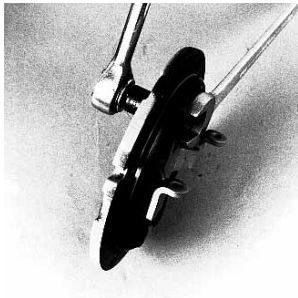
90000194

Fig. 61-14 - Remove Leveler Spring Seats ('Post' Type)



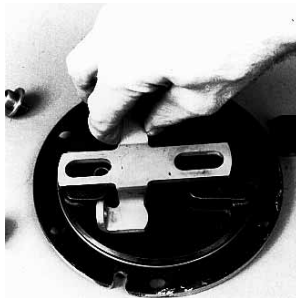
90000195

Fig. 61-15 - Remove Leveler Spring Seats ('Guide' Type)



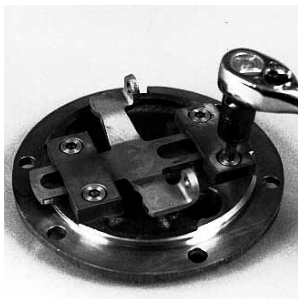
90000113

Fig. 61-16 - Remove Leveler Post Seal Nuts ('Post' Type)



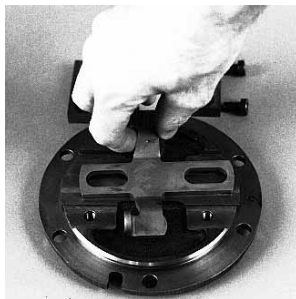
90000196

Fig. 61-17 - Remove Leveler ('Post' Type)



90000197

Fig. 61-18 - Remove Retaining Screws ('Guide' Type)



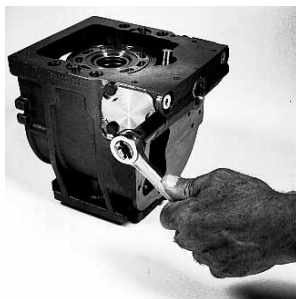
90000198

Fig. 61-19 - Remove Leveler ('Guide' Type)



90000114

Fig. 61-20 - Mark Servo Cylinders



90000115

Fig. 61-21 - Remove Servo Cylinder Screws

Remove spring seats from swashplate leveler.

NOTE: Earlier production pumps do not have removable (hardened) spring seats.

For units with leveler guide posts, remove the two (2) guide posts and sealing nuts holding the leveler to the side cover. Use a 17 mm open end wrench and a 10 mm hex wrench on 030 and 042 frame size pumps. Use a 3/4 in. open end wrench and a 13 mm hex wrench on 055, 075, and 100 frame size pumps. Use a 24 mm open end wrench and a 17 mm hex wrench on 130 frame size pumps. Remove swashplate leveler from side cover. Remove the side cover O-ring.

For 130 frame size units with leveler guides, remove the four (4) screws holding the leveler guides to the side cover with a 5 mm internal hex wrench. Remove the leveler guides from the cover. Remove swashplate leveler from side cover. Remove the side cover O-ring.

Mark the servo cylinders and housing to identity each servo cylinder with its respective side of the housing.

Remove the three (3) or four (4) screws retaining each servo cylinder to the housing, using a 10 mm or 13 mm hex wrench.

Major Repair - Variable Pump (Continued)

For earlier production units, carefully pry each cylinder from the housing by using a screwdriver in the notches in the cylinder. For later production units, install an 8 mm or 10 mm screw in the threaded hole in the center of each cylinder, and pull the cylinders from the housing. The servo piston will remain in the housing.

NOTE: For later production units with displacement limiters, remove the limiter screw from each servo cylinder and install an 8 mm or 10 mm screw in its place as a puller screw.

Remove the cylinder block through the housing end cap opening. The swashplate and piston assembly will remain in the housing.

Remove the swashplate bearing cage link pin from the housing through the control opening.

NOTE: A flat head screw is used as the link pin in 042 frame size pumps. It may be removed with a 3 mm internal hex wrench.

Remove the bearing cage locator link from the swashplate through the control opening.

Remove the swashplate and pistons through the housing side cover opening. Disengage the servo arm from the slider block located in the servo piston as the assembly is removed.

Remove the servo piston and slider block from housing.

NOTE: Units equipped with an automotive control have a threaded hole in one end of the servo piston for the centering assist spring assembly. For these units, note the orientation of the servo piston in the housing.

Remove the swashplate cradle bearing cage.

Remove the bearing races. The bearing races are a loose fit on two (2) locating pins in the housing.

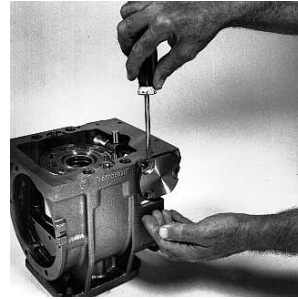


Fig. 61-22 - Remove Servo Cylinders

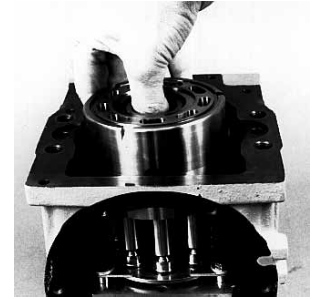


Fig. 61-23 - Remove Cylinder Block

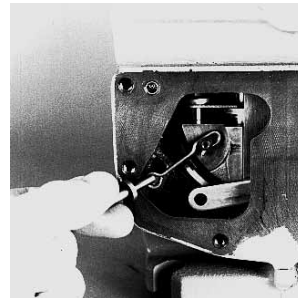


Fig. 61-24 - Remove Bearing Cage Link Pin

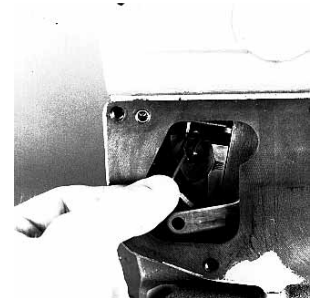


Fig. 61-25 - Remove Bearing Cage Locator Link

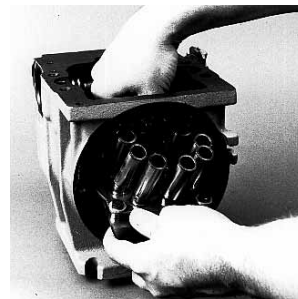


Fig. 61-26 - Remove Swashplate and Pistons

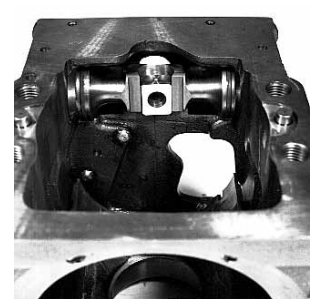


Fig. 61-27 - Remove Servo Piston and Slider Block

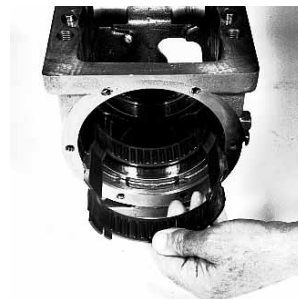


Fig. 61-28 - Remove Swashplate Bearing Cage

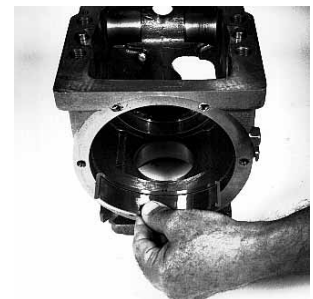
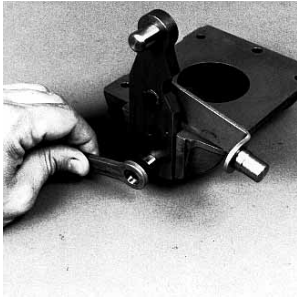


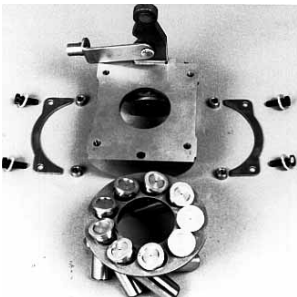
Fig. 61-29 - Remove Swashplate Bearing Races

Major Repair - Variable Pump (Continued)


90000199

Fig. 61-30 - Remove Feedback Link


90000125

Fig. 61-31 - Remove Hold Down Screws


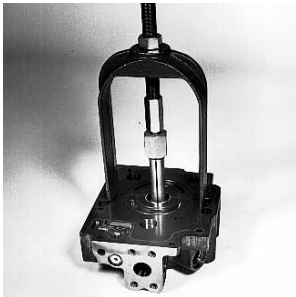
90000200

Fig. 61-32 - Remove Pistons and Guide from Swashplate (Later Production)

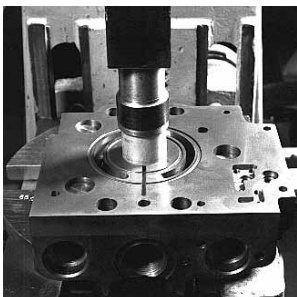

90000126

Fig. 61-33 - Remove Pistons and Guide from Swashplate (Earlier Production)

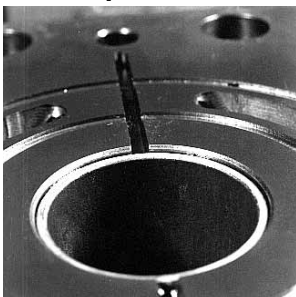

90000127

Fig. 61-34 - Remove Pistons from Slipper Guide


90000129

Fig. 61-35 - Remove Journal Bearing from End Cap


90000132

Fig. 61-36 - Install Journal Bearing in End Cap


90000133

Fig. 61-37 - Journal Bearing Installed in End Cap

Remove the feedback link from the head of the special screw on the swashplate assembly.

Using a 10 mm or 13 mm hex wrench, remove the four (4) screws holding the slipper guide hold down mechanism to the swashplate.

Disassemble the hold down mechanism and remove the slipper guide and pistons from the swashplate.

NOTE: Later production pumps use a fixed-clearance hold down mechanism. Earlier production 055 thru 100 frame size pumps use a spring-loaded hold down mechanism.

Remove the piston assemblies from the slipper guide.

Reconditioning and Replacement of Parts

After disassembly all parts should be thoroughly cleaned in a suitable solvent. Replace all O-rings, gaskets, and the shaft seal.

Inspect all parts for damage, nicks, or unusual wear patterns. Replace all parts having unusual or excessive wear or discoloration.

If the end cap journal bearing needs replacement (as evidenced by large amounts of the metal back of the bearing being visible through the plastic bearing material), remove the bearing with a suitable puller. Do not damage the valve plate surface of the end cap.

Lightly lubricate the steel backing of a new journal bearing. Press the journal bearing into the end cap using a suitable press pin.

When installed correctly, the bearing will be flush to 0.020 in (0.50 mm) below the valve plate surface of the end cap.

NOTE: For 042 frame size pumps, the bearing is located 0.827 to 0.846 in. (21.00 to 21.50 mm) from the front surface of the charge pump recess in the end cap.

Major Repair - Variable Pump (Continued)

If a new journal bearing is installed, the bearing must be sized with the appropriate arbor to assure the minimum bore diameter is met. Carefully press the sizing arbor into the bearing to size it.

CAUTION

The arbors are precision finished to size the journal bearings without damaging them. Damaged arbors must be replaced. Do not attempt to use the drive shaft in place of an arbor. Inadequate clearance between the shaft and bearing will result in inadequate lubrication and shortened bearing life.

NOTE: The charge pump shaft bushing in the end cap may be replaced in a similar manner to the drive shaft journal bearing.

Certain frame size pumps with twin port end caps may have the servo relief valves and rotation plugs located in a removable rotation block. Remove the rotation block screws with a 5 mm internal hex wrench and remove the block and gasket.

For pumps with pressure limiter function (except units with automotive control), remove the servo relief valves from the end cap or rotation block with a screw driver.

For pumps with pressure limiter defeat and/or automotive control, remove the servo relief passage plug(s) from the end cap or rotation block with a 3/16 in. internal hex wrench.

Note the position of the rotation pipe plugs and remove them from the end cap or rotation block with a 1/8 in. internal hex wrench.

Install the servo relief valves or relief valve passage plugs into the end cap or rotation block as shown in the accompanying illustrations and chart.

NOTE: Pumps with pressure limiter function (except those units with automotive control) MUST have servo relief valves installed in the end cap or rotation block to limit servo pressures.

Install the rotation pipe plugs into the end cap or rotation block as shown in the accompanying illustrations and chart.

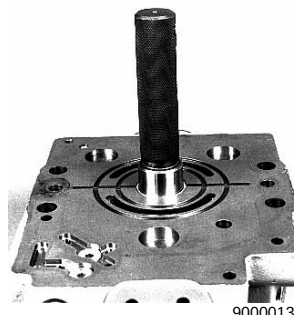


Fig. 61-38 - Sizing Journal Bearing

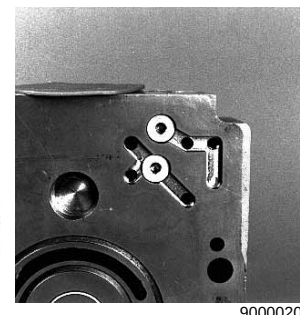


Fig. 61-39 - Servo Relief Valves and Rotation Plugs in End Cap (Typical)

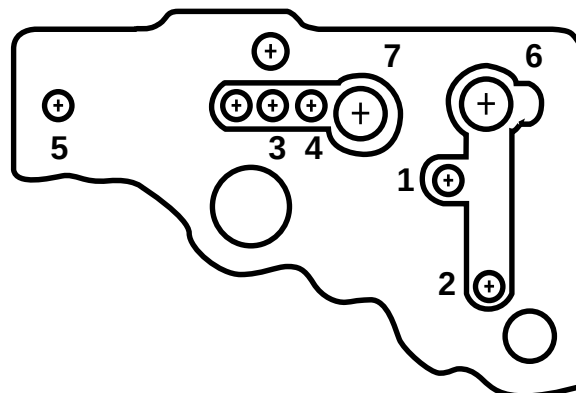


Fig. 61-40 - 030 Pump Twin Port End Cap

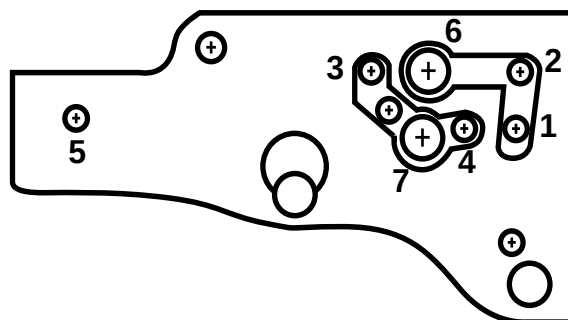


Fig. 61-41 - 042 Pump Twin Port End Cap

Major Repair - Variable Pump (Continued)

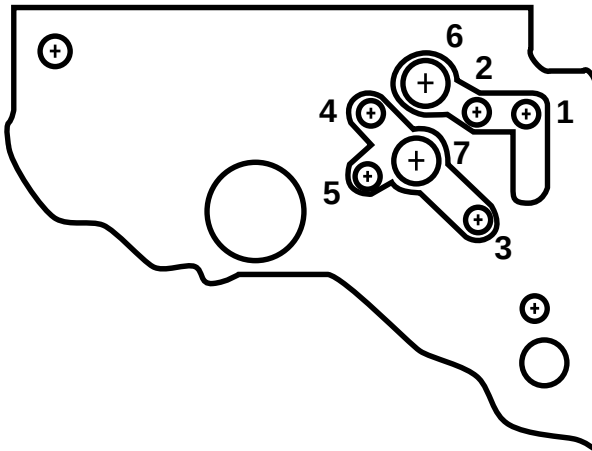


Fig. 61-42 - 055 Pump Side Port End Cap

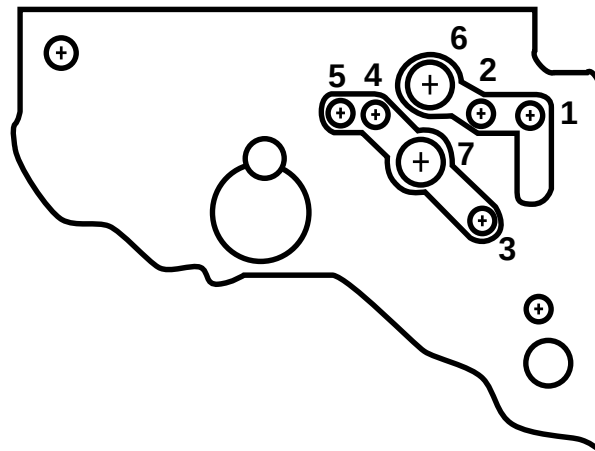


Fig. 61-43 - 055 Pump Twin Port End Cap

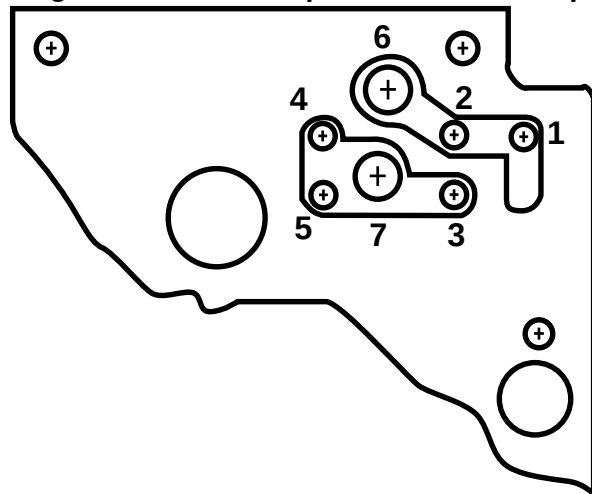


Fig. 61-44 - 075 Pump Side Port End Cap

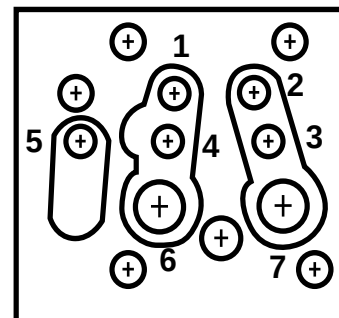


**Fig. 61-45 - 075 Pump Twin Port End Cap
Rotation Block**

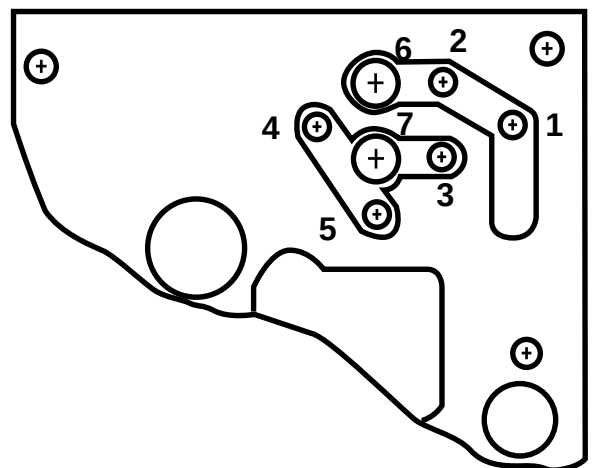


Fig. 61-46 - 100 Pump Side Port End Cap

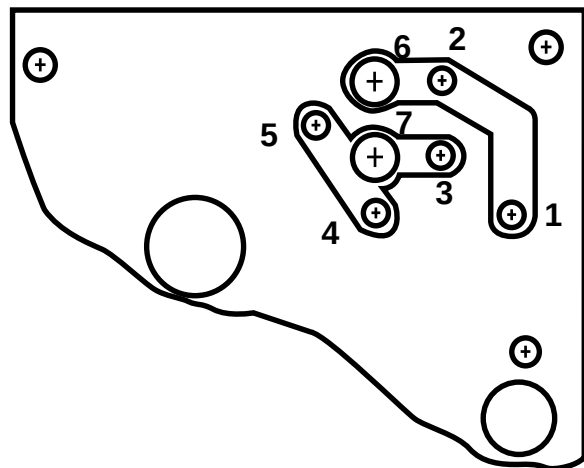


Fig. 61-47 - 100 Pump Twin Port End Cap

Major Repair - Variable Pump (Continued)

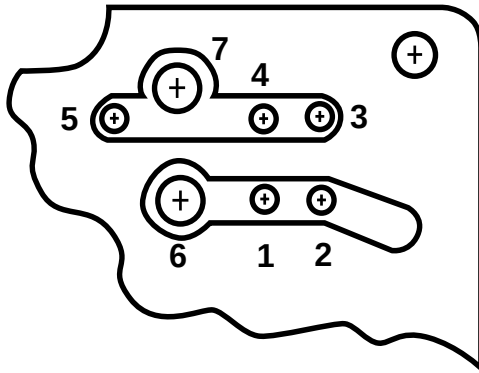


Fig. 61-48 - 130 Pump Twin Port End Cap

Pressure Limiter		Pump Rotation	Pipe Plugs in Holes	Servo Relief Valves (O-Ring Plugs for Automotive Control) in Hole	O-Ring Plugs in Holes	Open Holes
Port "A"	Port "B"					
YES	YES	R (CW)	1, 3	6, 7	None	2, 4, 5
YES	YES	L (CCW)	2, 4	6, 7	None	1, 3, 5
NO	NO	EITHER	1, 2, 5	None	6	3, 4, 7

WARNING

Uncontrollable movement of the vehicle / machine and its attachments can result from installing the pressure limiter logic plugs in the incorrect ports for the pump rotation. Correct pressure limiter function **MUST** be verified. This can be accomplished by testing the pump before it is installed, or by defining and performing a test in the vehicle / machine before it is released from repair.

Torque the servo relief valves or relief valve passage plugs to 9 ft.lbsf. (12 Nm). Torque the rotation pipe plugs to 4 ft.lbsf. (5.4 Nm).

When reinstalling the rotation block and gasket, torque the screws to 12 ft.lbsf. (16 Nm).

Major Repair - Variable Pump (Continued)



90000128

Fig. 61-49 - Clean Threaded Holes in Swashplate

The threaded holes in the swashplate (for the hold down screws) must be cleaned of old locking compound prior to reassembly. A 6 mm (030 thru 100 pumps) or 8 mm (130 pumps) thread tap may be used for this purpose.

Inspect the swashplate guide for wear. The guide may be removed by removing the special locking screw with a 5 mm (030, 042), 6 mm (055, 075, 100), or 8 mm (130) internal hex wrench.

Servo arm alignment is critical to proper pump operation. For this reason, removal of the servo arm from the swashplate is not recommended.

If the servo arm must be removed from the swashplate, remove the locking screw with a 13 mm (030, 042, 055, 075) or 17 mm (100, 130) hex wrench.

“Keystone” design servo arms must be parallel (within 0.010 in [0.25 mm] total) to the wide surface of the slot in the swashplate when installed. “Press fit” design servo arms must be carefully aligned with the slot and threaded holes in the swashplate while installing, and must be pressed completely into the swashplate slot.

NOTE: “Keystone” design servo arms and swashplates are no longer available for servicing 055, 075, and 100 frame size pumps. A swashplate / servo arm kit is available to service these units. Refer to the appropriate Service Parts Manual for more information.

Torque the servo arm to swashplate locking screw to 24 ft.lbsf. (32 Nm) for 030, 042, 055, and 075 pumps, 31 ft.lbsf. (42 Nm) for 100 pumps, or 47 ft.lbsf. (64 Nm) for 130 pumps.



90000202

Fig. 61-50 - Torque Swashplate Guide Screw

Assemble the swashplate guide to the swashplate with the special locking screw. Torque the screw to 10 ft.lbsf. (13.5 Nm) for 030 and 042 pumps, 24 ft.lbsf. (32 Nm) for 055, 075, and 100 pumps, or 40 ft.lbsf. (54 Nm) for 130 pumps.

NOTE: Later production 100 pumps use the same size swashplate guide as 075 pumps. When installing the guide onto the 100 swashplate, be certain the straight sides of the guide are perpendicular to the slipper surface of the swashplate while tightening the screw.

Major Repair - Variable Pump (Continued)

If the the headed roll pin and flat washer for the bearing cage locator link must be installed on the swashplate, the distance between the washer and the side of the swashplate must be as indicated below:

Pump Frame Size	Distance "H" +0.003, -0.010 in. (+0.01, -0.25 mm)
030	.100 (2.50) [washer not used]
Pump Frame Size	Distance "H" ±0.010 in. (±0.25 mm)
042	.140 (3.60)
055	.21 (5.33)
075	.240 (9.45)
100	.170 (4.32)
130	.220 (5.59)
180	
250	

Inspect the servo piston and seal rings for wear. If worn, remove the seal rings and expander O-rings from the piston.

Install new expander O-rings into the seal grooves in the servo piston.

Carefully install the piston seal rings in the piston grooves, over the expander O-rings. Do not stretch the seal rings any more than necessary when installing.

Lubricate the seal rings and carefully slide the servo piston into the servo cylinders. Allow the assembly to set for at least 5 minutes to allow the seal rings to return to their original "unstretched" size. Then remove the servo cylinders.

Compress the cylinder block spring and remove the spiral retaining ring, retainer, spring, and spring seat. Reassemble in the reverse order.

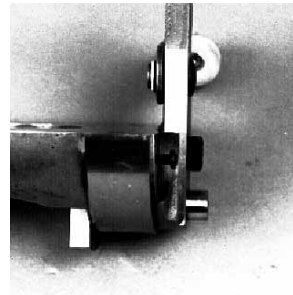


Fig. 61-51 - Roll Pin and Washer Installed

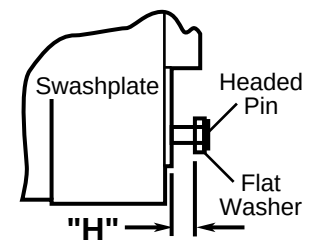


Fig. 61-52 - Roll Pin and Washer Dimension



Fig. 61-53 - Install Servo Piston Seal Expander Ring



Fig. 61-54 - Install Servo Piston Seal Ring

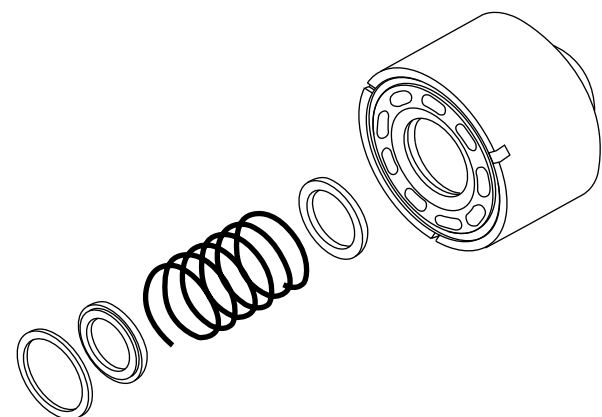


Fig. 61-55 - Cylinder Block Spring Components

Major Repair - Variable Pump (Continued)

Assembly Procedures for Variable Displacement Pump

Clean and lightly oil all parts prior to assembly of the pump. Be sure to torque all threaded parts to recommended torque levels.

CAUTION

Most parts have critical, high tolerance surfaces. Caution must be exercised to prevent damage to these surfaces during assembly. Protect exposed surfaces, openings, and ports from damage and foreign material.

Assemble the piston assemblies into the slipper guide.

Lubricate the slipper running surfaces. Center the pistons and guide on the swashplate.

NOTE: Later production pumps use a fixed-clearance hold down mechanism. Earlier production 055, 075, and 100 frame size pumps use a spring-loaded hold down mechanism. Service parts for the spring-loaded hold down mechanism are no longer available. If hold down parts require replacement on these earlier production units, the fixed-clearance hold down mechanism must be installed. Refer to the appropriate Service Parts Manual for more information.

Assemble one-half of the fixed-clearance hold down mechanism as follows:

Position two (2) spacers over the threaded holes in the swashplate as shown.

Position the slipper guide bearing on top of the spacers and slipper guide.

CAUTION

The "split" between the slipper guide bearing plates must be located in line with the swashplate arm. The bearing surface of the bearing plates must be located next to the guide.



90000127

Fig. 61-56 - Install Piston Assemblies into Slipper Guide



90000135

Fig. 61-57 - Position Pistons and Guide on Swashplate



90000205

Fig. 61-58 - Position Spacers



90000206

Fig. 61-59 - Position Guide Bearing

Major Repair - Variable Pump (Continued)

Install two (2) new screws (with locking compound) and flat washers through the slipper guide bearing, and spacers. Finger tighten the screws into the swashplate.

NOTE: Inspect the flat washers for raised edges or "burrs." The smooth side of the flat washers must be installed next to the slipper guide bearing.

CAUTION

Always use new screws with proper locking compound.

Assemble the other half of the fixed-clearance hold down mechanism in a similar manner.

Assemble one-half of the spring-loaded hold down mechanism as follows:

Lubricate the slipper guide bearing and position it on top of the slipper guide.

CAUTION

The "split" between the slipper guide bearing plates must be located in line with the swashplate arm. The bearing surface of the bearing plates must be located next to the slipper guide.

Position two (2) spacers in the holes of the guide bearing and over the threaded holes in the swashplate as shown.

Position two (2) flat washers on top of the spacers.

Position two (2) leaf springs on top of the washers.

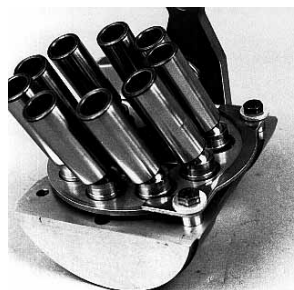
Position two (2) spring aligners on top of the leaf springs.

Install two (2) new screws (with locking compound) through the spring aligners, leaf springs, flat washers, and spacers. Finger tighten the screws into the swashplate.

CAUTION

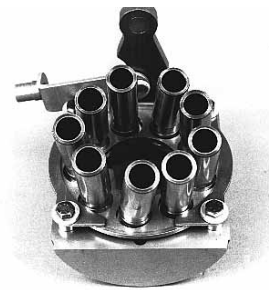
Always use new screws with proper locking compound.

Assemble the other half of the spring-loaded hold down mechanism in a similar manner.



90000136

Fig. 61-60 - Install Screws and Flat Washers



90000137

Fig. 61-61 - Fixed-Clearance Hold Down Assembled



90000207

Fig. 61-62 - Position Slipper Guide Bearing



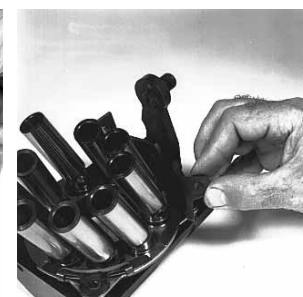
90000208

Fig. 61-63 - Position Spacers



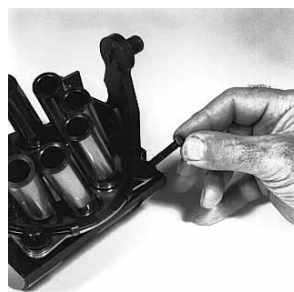
90000209

Fig. 61-64 - Position Flat Washers



90000210

Fig. 61-65 - Position Leaf Springs and Spring Aligners



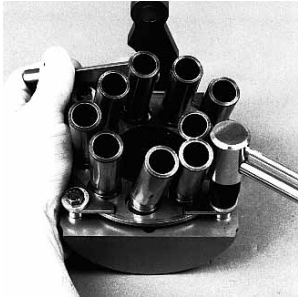
90000211

Fig. 61-66 - Install Screws



90000212

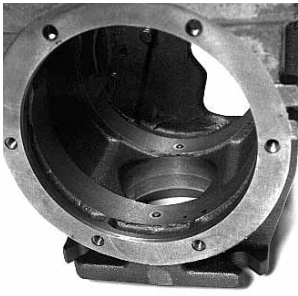
Fig. 61-67 - Spring-Loaded Hold Down Assembled

Major Repair - Variable Pump (Continued)


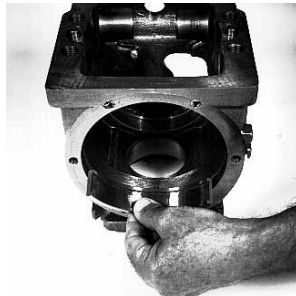
90000138

Fig. 61-68 - Torque Hold Down Screws

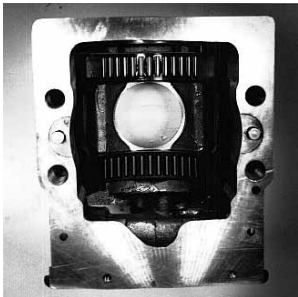

90000139

Fig. 61-69 - Install Pistons into Cylinder Block


90000140

Fig. 61-70 - Bearing Race Locator Pins in Housing


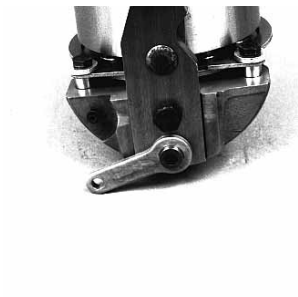
90000124

Fig. 61-71 - Install Swashplate Bearing Races


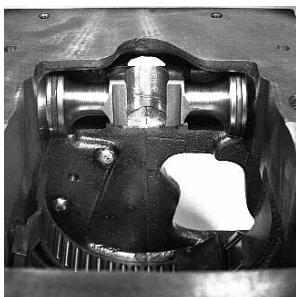
90000213

Fig. 61-72 - Bearing Cage Installed


90000143

Fig. 61-73 - Install Slider Block


90000144

Fig. 61-74 - Install Feed Back Link


90000142

Fig. 61-75 - Position Servo Piston

Torque the hold down screws to 10 ft.lbsf. (13.5 Nm) for 030 thru 100 frame size pumps, or 24 ft.lbsf. (32.5 Nm) for 130 pumps.. The slipper guide and piston slippers must be able to slide freely on the swashplate.

Lubricate the pistons and cylinder block bores. Install the assembled swashplate and pistons into the cylinder block by inserting the pistons into the cylinder block bores. The pistons and bores are not selectively fitted, therefore no specific piston and bore orientation is required.

Check that the swashplate bearing race locating pins are secure in the housing.

Install the swashplate bearing races into the housing, positioning the races on the locating pins. Retain the races in position with petroleum jelly. The locating pins are offset in the housing to assure proper assembly.

Assemble and lubricate the bearing cage, and install it on the bearing races.

Install the bronze slider block on the swashplate servo arm.

Install the feedback link on the head of the special screw on the swashplate assembly.

WARNING

To avoid the possibility of the pump sticking in stroke, the feedback link must NOT be installed in pumps equipped with non-feedback controls (such as the cover plate, 3-position solenoid, and automotive control).

Position the servo piston in the housing.

NOTE: For units equipped with an automotive control, the machined end of the servo piston (with the threaded hole) must be located on the side of the housing where the centering assist spring sleeve will be installed.

Major Repair - Variable Pump (Continued)

Carefully lower the cylinder block and swashplate assembly into the housing through the end cap opening.

NOTE: A tool to aid in holding and installing the assembled cylinder block and swashplate may be made from a positive lock, quick release pin and a large flat washer (1 inch inside diameter with clearance flats ground on the outside diameter). Insert the pin thru the cylinder block and swashplate, and lock in place with the flat washer under the swashplate.

Hold the cylinder block and swashplate assembly approximately 1/2" (12 mm) above the cradle bearings.

Properly position the feedback link in the control opening.

Position the servo piston on the slider block, taking care not to wedge the block. The parts should slide freely.

Lower the cylinder block and swashplate assembly until the swashplate is properly located on the cradle bearings.

NOTE: If an assembly tool was used to install the cylinder block and swashplate, release and remove the pin. The flat washer should fall through the shaft opening of the housing.

Hold the servo piston in position and install the servo cylinders.

NOTE: Be sure to assemble the correct servo cylinder on each side of the housing. For units equipped with an automotive control, a special servo cylinder is installed on the centering assist spring side of the housing.

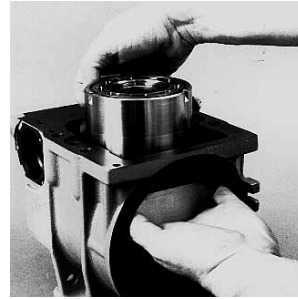


Fig. 61-76 - Install Cylinder Block and Swashplate



Fig. 61-77 - Install Cylinder Block and Swashplate

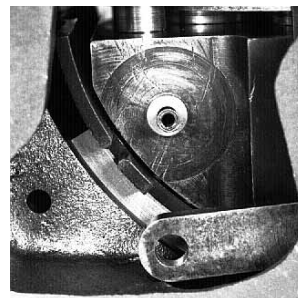


Fig. 61-78 - Position Feedback Link

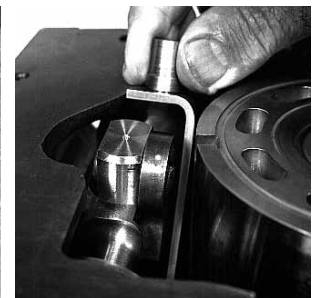


Fig. 61-79 - Position Servo Piston and Slider Block

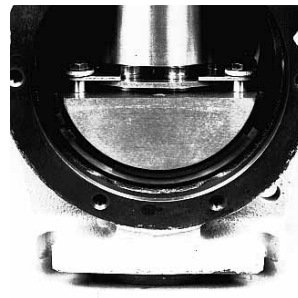


Fig. 61-80 - Lower Swashplate onto Bearings

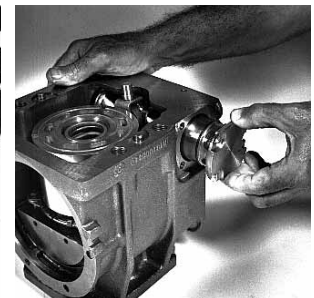


Fig. 61-81 - Install Servo Cylinders

Major Repair - Variable Pump (Continued)



**Fig. 61-82 - Torque
Cylinder Screws**

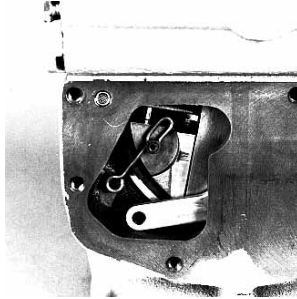


**Fig. 61-83 - Install
Cage Locator Link**

Install the three (3) or four (4) screws in each servo cylinder. Torque to 10 ft.lbsf. (13.5 Nm) for 030 thru 055 pumps, 18 ft.lbsf. (24 Nm) for 075 pumps, and 24 ft.lbsf. (32 Nm) for 100 and 130 pumps.

NOTE: For units equipped with an automotive control, the servo cylinder screws on the centering assist spring side of the housing will be installed later.

Align the slot in the swashplate bearing cage with the headed spring pin in the swashplate and the pin hole in the housing. Hook the cage locator link over the spring pin, between the washer and the swashplate. Rotate the link into the slot in the bearing cage.

NOTE: A washer is not installed on the spring pin in 030 frame size pumps.

Align the hole in the locator link with the hole in the housing and install the link anchor pin thru the link and into the housing.

A flat head screw is used as the link pin in 042 frame size pumps. Install a new screw (with locking compound) through the locator link and into the housing. Tighten the screw into the housing until the head of the screw is positioned at a height (distance "H") of 0.178 to 0.188 in. (4.53 to 4.79 mm) from the machined surface of the pump housing.

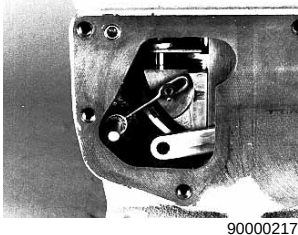


**Fig. 61-84 - Install
Locator Link Pin**

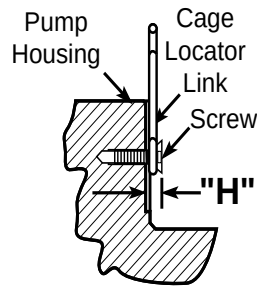


**Fig. 61-85 - Install
Locator Link Screw
(042 Pumps)**

CAUTION

Always use a new screw with proper locking compound. Do NOT torque this screw against the locator link. The link MUST rotate freely.

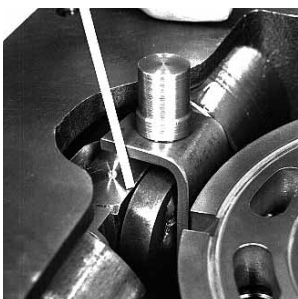


**Fig. 61-86 - Check
for Servo Arm to
Slider Block
Clearance**

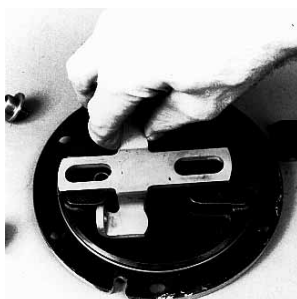


**Fig. 61-87 - Install
Leveler on Side
Cover**

Push the swashplate assembly toward the control side of the housing until the swashplate guide contacts the bearing race. Check for clearance between the servo arm and the slider block. If no clearance is present, recheck the assembly of the bearing cage and races.

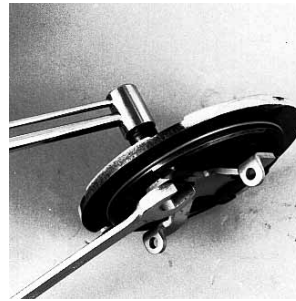
Position the swashplate leveler ("T-Bar") on the side cover. Note the orientation of the leveler and the cover.

Major Repair - Variable Pump (Continued)

For units with leveler guide posts, install the two (2) guide posts and sealing nuts. Torque to 6.7 lbf•ft (9.0 Nm) for 030 and 042 pumps, 17 lbf•ft (23 Nm) for 055 thru 100 pumps, or 32 lbf•ft (54 Nm) for 130 pumps.

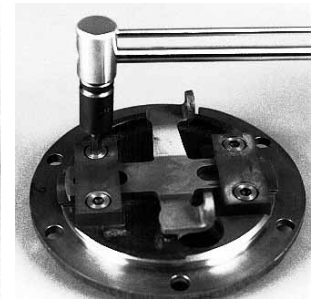
For 130 frame size units with leveler guides, install the guides onto the side cover. Install the four (4) locking screws holding the guides to the side cover. Torque to 6.7 lbf•ft (9.0 Nm).

NOTE: If the screw holes in the side cover are “thru” holes, the threads of the screws must be coated with sealing compound.



90000154

Fig. 61-88 - Install Leveler Posts and Nuts (“Post” Type)



90000219

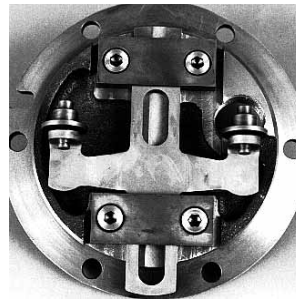
Fig. 61-89 - Install Leveler Guides and Screws (“Guide” Type)

Install the leveler spring seats.

NOTE: Earlier production pumps do not have removable (hardened) swashplate leveler spring seats.

Install the inner spring spacer washers (if used).
Install a new side cover O-ring.

Hold the swashplate leveler toward the end cap end of the housing so the leveler will clear the side of the swashplate during side cover installation. Install the side cover and swashplate leveler.



90000220

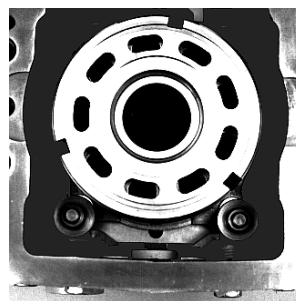
Fig. 61-90 - Leveler Spring Seats Installed



90000155

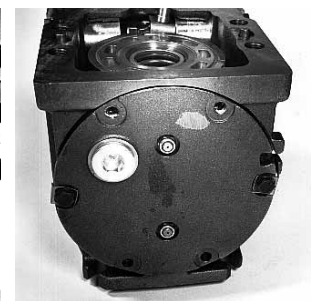
Fig. 61-91 - Install Side Cover on Housing

Install two (2) side cover screws (with flat washers) finger tight into the blind holes in the housing, to hold the cover while checking the “zero angle” position of the swashplate.



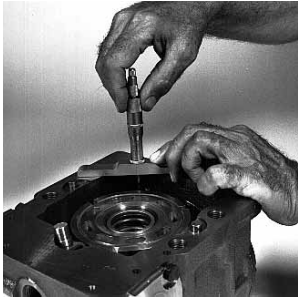
90000221

Fig. 61-92 - Leveler Positioned on Swashplate

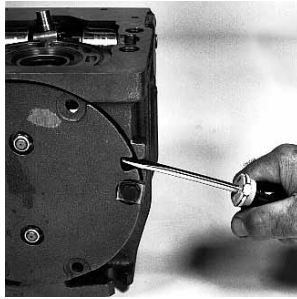


90000156

Fig. 61-93 - Install Two (2) Side Cover Screws

Major Repair - Variable Pump (Continued)


90000158

Fig. 61-94 - Measure Swashplate Position


90000159

Fig. 61-95 - Rotate Side Cover to Establish "Zero Angle"

If all the parts which affect the zero angle setting are being reused, rotate the side cover to align the marks on the cover and housing that were made at disassembly.

Apply a force of 5 to 10 lbf. (22 to 44 N) to the swashplate leveler to ensure both arms are in contact with the swashplate. Make sure the swashplate is properly located on its bearings. Use a depth micrometer to measure the distance from the end cap face of the housing to the outer edge of the swashplate surface. Take a second measurement at a point 180° from the first point of measurement (at the opposite edge of swashplate surface). These measurements must not vary by more than .001 in (.025 mm).

Rotate the side cover (which will also rotate the leveler and swashplate) until the zero angle position is established, as determined by the depth measurement.

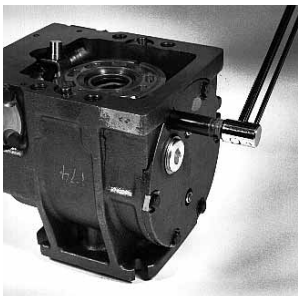
After the zero angle position has been established, tighten the two (2) screws to hold the side cover.

Install the remaining four (4) screws with flat washers.

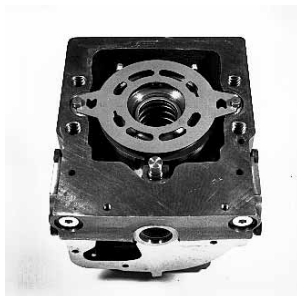
NOTE: The threads of the two (2) side cover screws installed in "thru" holes in the housing must be coated with a sealing compound to prevent leaks. New screws have sealant pre-applied.

First, torque the four (4) side cover screws installed in "blind" holes to 10 ft.lbsf. (13.5 Nm) for 030 and 042 pumps, 24 ft.lbsf. (32.5 Nm) for 055 thru 100 pumps, and 47 ft.lbsf. (64 Nm) for 130 pumps.

Then, torque the two (2) side cover screws installed in "thru" holes to 7.7 ft.lbsf. (10.4 Nm) for 030 and 042 pumps, 18.5 ft.lbsf. (25 Nm) for 055 thru 100 pumps, and 37 ft.lbsf. (50 Nm) for 130 pumps.



90000160

Fig. 61-96 - Torque Side Cover Screws


90000109

Fig. 61-97 - Install Alignment Pins and Valve Plate

Install the end cap alignment pins into the housing. Lubricate the running surface of the cylinder block and install the valve plate on the alignment pins.

NOTE: Note the direction of the arrow cut-outs in the valve plate. The arrows must point in the direction of pump rotation. For example, a right hand (clockwise) rotation pump must have the arrows pointing in the clockwise direction (when viewed from the shaft end). (The photo on this page shows a valve plate installed for clockwise [CW] rotation.)

Major Repair - Variable Pump (Continued)

Install the two (2) long springs (with inner springs, if used) on the swashplate leveler spring seats. Install the short spring on the servo arm link. Place new end cap gasket on the housing (located by the alignment pins). Take care not to bend or damage the end cap gasket during installation.

Lubricate the end cap journal bearing. Install the hardened shims in the end cap pockets for the swashplate leveler springs. Retain the shims with petroleum jelly.

Lower end cap onto housing while positioning the three (3) springs in their pockets in the end cap.

When properly installed, the end cap will engage the alignment pins, but the springs will hold the end cap 1/8 to 1/4 in. (3 to 8 mm) away from the housing.

Install the four (4) large end cap screws.

NOTE: If the pump will be equipped with an auxiliary mounting pad, temporarily install two (2) of the large screws which fasten the end cap to the housing. These screws will hold the end cap against internal spring pressure while the small screws are installed.

Tighten the large end cap screws evenly to the torque indicated in the accompanying table.

Frame Size	Torque	
	lbf•ft	Nm
030	43	58
042	55	75
055	90	122
075	189	256
100	200	271
130	220	298
180		
250		

Install the two (2) or three (3) smaller screws holding the end cap to the housing. Torque the 6 mm screws to 10 ft.lbsf (13.5 Nm), and the 8 mm screws to 28 ft.lbsf (38 Nm).

NOTE: A lifting bracket is installed on one (1) of the smaller end cap screws.

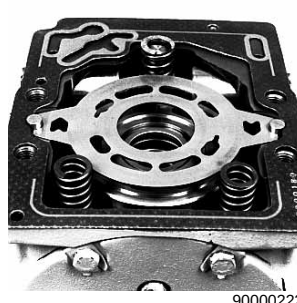


Fig. 61-98 - Install Springs and End Cap Gasket

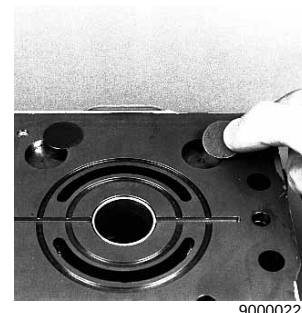


Fig. 61-99 - Install Leveler Spring Shims

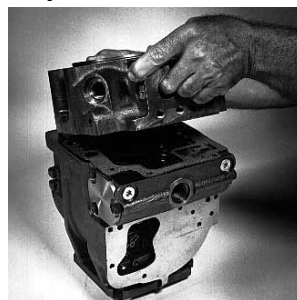


Fig. 61-100 - Install End Cap



Fig. 61-101 - End Cap Installed

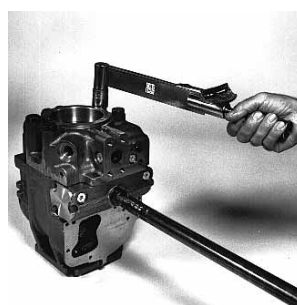


Fig. 61-102 - Install Large End Cap Screws

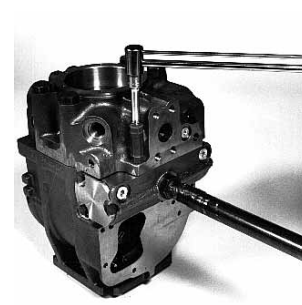


Fig. 61-103 - Install Small End Cap Screws

Major Repair - Variable Pump (Continued)



Fig. 61-104 - Shaft Bearing Installed



Fig. 64-105 - Install Shaft Assembly

Position the pump on its end cap.

Using caution to prevent damage to the sealing surface, press the roller bearing onto the drive shaft. (For units with a 3-piece bearing, press the inner race onto the shaft, then install the outer race/cage assembly and the special washer.) Install the bearing retaining ring onto the shaft.

Install the shaft and bearing assembly through front of housing, aligning the shaft spline with the cylinder block spline. Continue to lower the shaft into the unit and carefully align the end of the shaft with the end cap journal bearing. Then lower the shaft and bearing assembly into position.

Rotate the shaft by hand. The rotating assembly should turn freely. If it does not rotate freely, the pump must be disassembled and the problem corrected.

Assemble and adjust the following components as described in the "Minor Repair" section of the Series 90 Service Manual:

- Charge Pump
- Auxiliary Mounting Pad (Where Applicable)
- Shaft Seal
- Control
- Filter Option
- Charge Relief Valve
- Multi-Function Valves
- Displacement Limiter(s)

Rotate the pump shaft with a torque wrench to assure correct assembly. When properly assembled, the torque required to turn the shaft (after "break-away") should be within the ranges shown in the accompanying table.

Torque to Turn Shaft (Variable Pump at 0°) ft.lbsf. (Nm)		
Frame Size	Minimum	Maximum
030	2 (2.7)	7.5 (10.2)
042		
055	4 (5.4)	9 (12.2)
075	5 (6.71)	10 (13.6)
100	7.5 (10)	13 (17.6)
130	9 (12.2)	15.5 (21)
180		
250		

WARNING

Always test the pump prior to putting it into service to verify correct pressure limiter and control function. Improper function of these systems can result in uncontrollable movement of the vehicle / machine.

Major Repair - Fixed Motor

General

The procedures on the following pages are for the complete disassembly and reassembly (Major Repair) of the Series 90 Fixed Displacement Motor.

Cleanliness is a primary means of assuring satisfactory hydraulic motor life, on either new or repaired units. Cleaning parts by using a clean solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material.

During the assembly of the Series 90 fixed motor, all surfaces which have relative motion between two parts should be coated with a film of clean hydraulic oil. This will assure that these surfaces will be lubricated during start-up.

It is recommended that all O-rings and gaskets be replaced. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly. All gasket sealing surfaces must be cleaned prior to installing new gaskets.

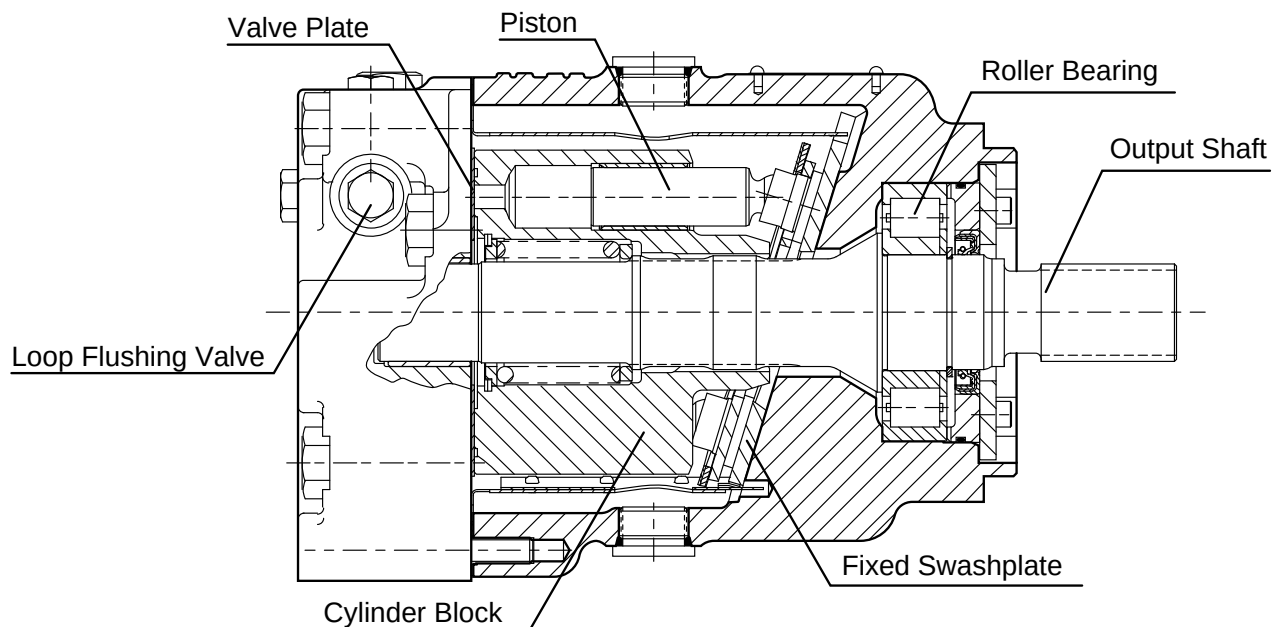


Fig. 62-1 - Cross Section View of Series 90 Fixed Displacement Motor

90000190

Major Repair - Fixed Motor (Continued)
Disassembly Procedures for Fixed Displacement Motor

Prior to performing Major Repairs on the Series 90 Fixed Displacement Motor, remove the external components as described in the "Minor Repair" section of the Series 90 Service Manual. These include the following:

- Charge Relief Valve
- Loop Flushing Valve
- Shaft Seal

After removal of the components defined in "Minor Repair," place motor on the end cap.

Remove the shaft and bearing assembly from the housing. The bearing outside diameter is a slip fit in the housing bore.



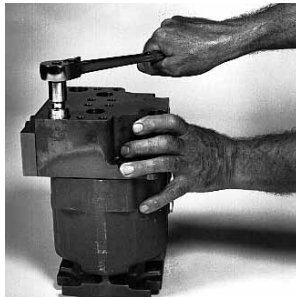
90000187

Fig. 62-2 - Motor Positioned on End Cap


90000164

Fig. 62-3 - Remove Shaft and Bearing


90000225

Fig. 62-4 - Remove Bearing from Shaft


90000165

Fig. 62-5 - Remove Longer End Cap Screws

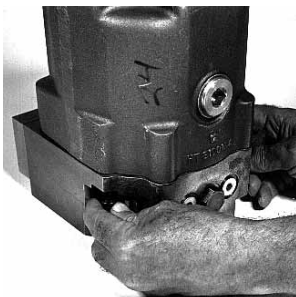
Remove the retaining ring and press the shaft out of the bearing.

Place the motor on the work surface with the end cap up. Using a 19 mm and a 13 mm hex wrench for 055 motors, a 19 mm and a 17 mm hex wrench for 075 motors, or a 24 mm and a 17 mm hex wrench for 100 and 130 motors, loosen the screws which retain the end cap to the housing. Remove the five (5) longer screws.

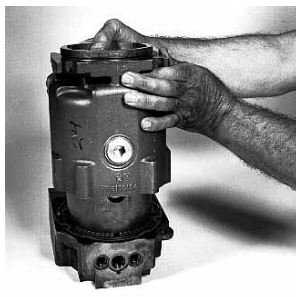
Place the motor on its end cap. Remove the two (2) shorter screws holding the end cap to housing.

Lift the housing off of the end cap.

NOTE: The dowel pins and gasket should remain with the end cap. The thrust plate should remain in the housing. The piston assemblies should remain with the other internal parts on the end cap, but may stick to the thrust plate.



90000185

Fig. 62-6 - Remove Shorter End Cap Screws


90000184

Fig. 62-7 - Remove Housing

Major Repair - Fixed Motor (Continued)

Place the housing on the end cap face with soft material between end of housing and work table so the thrust plate will not be damaged when it is freed from housing.

Entering thru the shaft end of the housing, using a brass rod, carefully apply a force to the I.D. of the thrust plate and disengage from the housing.



Fig. 62-8 - Remove Thrust Plate from Housing

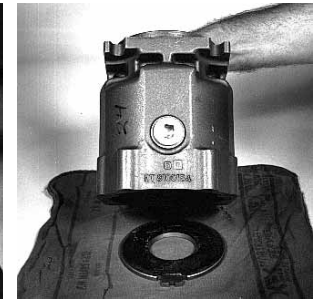


Fig. 62-9 - Thrust Plate Removed

Remove the end cap gasket from the end cap.

Remove the hold down tube with the slipper guide and piston assemblies from the end cap and cylinder block.

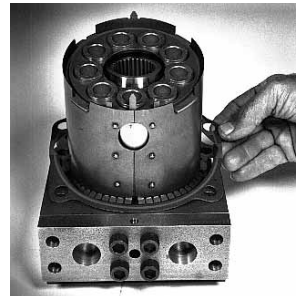


Fig. 62-10 - Remove End Cap Gasket

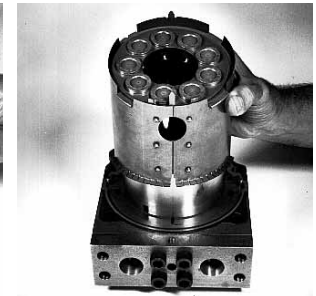


Fig. 62-11 - Remove Tube with Slipper Guide and Pistons

Remove the slipper guide and piston assemblies from the hold down tube.

Remove the slipper guide bearing.



Fig. 62-12 - Remove Slipper Guide and Pistons



Fig. 62-13 - Remove Slipper Guide Bearing

Remove the slipper guide bearing shim (if used).

Remove the cylinder block from the end cap.



Fig. 62-14 - Remove Slipper Guide Bearing Shim



Fig. 62-15 - Remove Cylinder Block

Major Repair - Fixed Motor (Continued)

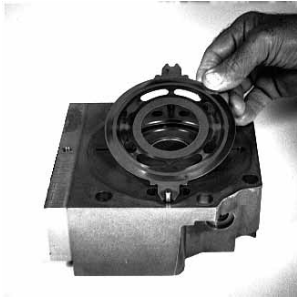


Fig. 62-16 - Remove Valve Plate



Fig. 62-17 - Remove Pistons from Slipper Guide

Remove the valve plate and alignment pins from the end cap

Remove the piston assemblies from the slipper guide.



Fig. 62-18 - Remove Journal Bearing from End Cap

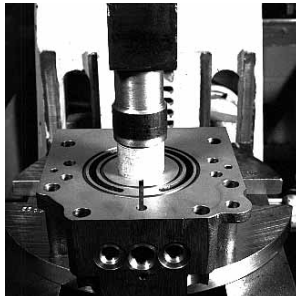


Fig. 62-19 - Install Journal Bearing in End Cap

Reconditioning and Replacement of Parts

After disassembly all parts should be thoroughly cleaned in a suitable solvent. Replace the shaft seal and all gaskets.

Inspect all parts for damage, nicks, or unusual wear patterns. Replace all parts having unusual or excessive wear or discoloration.

If the end cap journal bearing needs replacement (as evidenced by large amounts of the metal back of the bearing being visible through the plastic bearing material), remove the bearing with a suitable puller. Do not damage the valve plate surface of the end cap.

Lightly lubricate the steel backing of a new journal bearing. Press the journal bearing into the end cap using a suitable press pin. The split line in the bearing must be located as shown in the accompanying illustrations, but NOT in line with the drain groove in the end cap bearing bore.

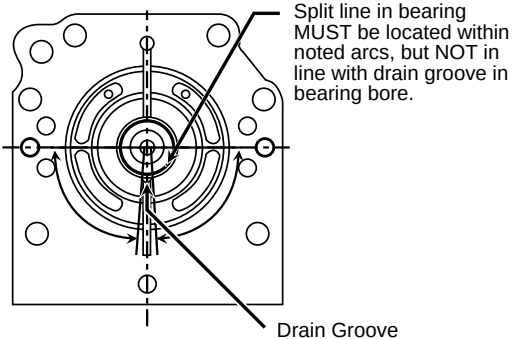


Fig. 62-20 - Orientation of Split Line in Journal Bearing (Earlier Production)

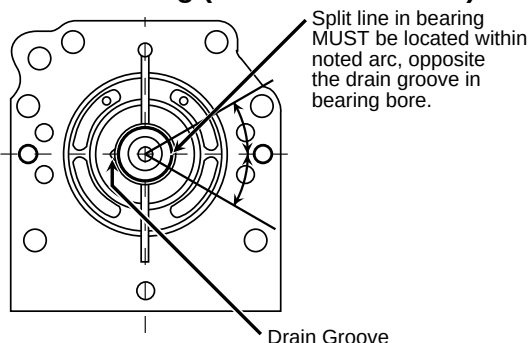


Fig. 62-21 - Orientation of Split Line in Journal Bearing (Later Production)

Major Repair - Fixed Motor (Continued)

When installed correctly, the bearing will be flush to 0.020 in (0.50 mm) below the valve plate surface of the end cap.

If a new journal bearing was installed, the bearing must be sized with the appropriate arbor to assure the minimum bore diameter is met. Carefully press the sizing arbor into the bearing to size it.

CAUTION

The arbors are precision finished to size the journal bearings without damaging them. Damaged arbors must be replaced. Do not attempt to use the drive shaft in place of an arbor. Bearing damage and shortened life will result from inadequate lubrication clearance.

Compress the cylinder block spring and remove the spiral retaining ring, retainer, spring, and spring seat. Reassemble in the reverse order.

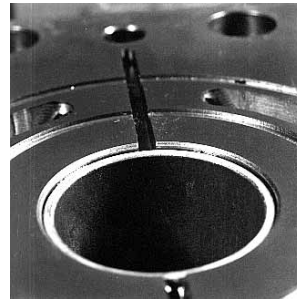


Fig. 62-22 - Journal Bearing Installed in End Cap

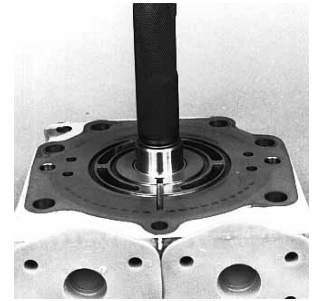


Fig. 62-23 - Sizing Journal Bearing

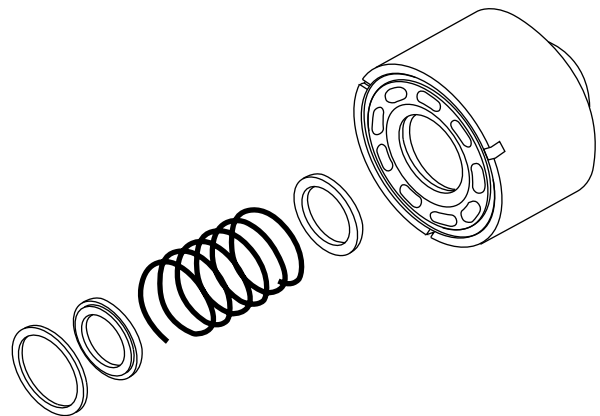


Fig. 62-24 - Cylinder Block Spring Components

Major Repair - Fixed Motor (Continued)
Assembly Procedures for Fixed Displacement Motor

Clean and lightly oil parts prior to assembly of the motor. Be sure to torque all threaded parts to recommended torque levels.

CAUTION

Most parts have critical, high tolerance surfaces. Caution must be exercised to prevent damage to these surfaces during assembly. Protect exposed surfaces, openings, and ports from damage and foreign material.

Place the end cap on the work surface with the valve plate surface up. Install the alignment pins in the end cap.

NOTE: The size of the alignment pins has changed on certain frame size motors. Refer to the appropriate Service Parts Manual for more information.

Install the valve plate on the end cap with the locating notches positioned over the alignment pins.

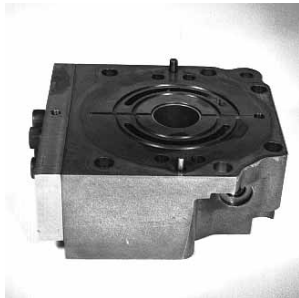
NOTE: This is a bi-directional valve plate, with no directional arrow cut-outs. It can be assembled with either side adjacent to the end cap.

Lubricate the end cap journal bearing and the cylinder block and valve plate running surfaces. Position the cylinder block assembly on the valve plate.

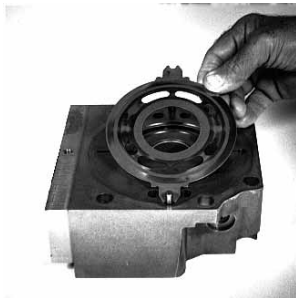
Place the hold down tube over the cylinder block with the fluted end adjacent to the end cap.

NOTE: If a new housing is to be installed, a new tube must also be used.

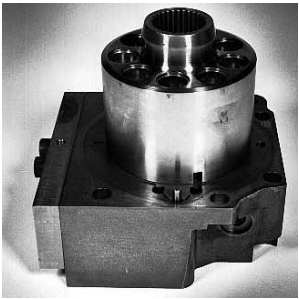
Position the straight fingers on the hold down tube over the valve plate locating tabs and in the clearance holes in the end cap. The long side of the tube must be positioned on the same side as the end cap gauge ports.



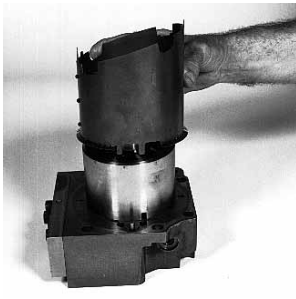
90000166

Fig. 62-25 - Install Alignment Pins


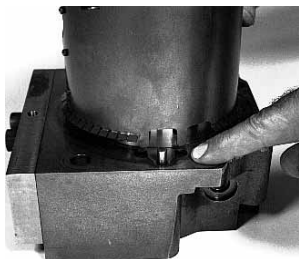
90000174

Fig. 62-26 - Install Valve Plate


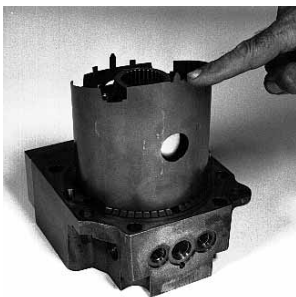
90000175

Fig. 62-27 - Position Cylinder Block


90000176

Fig. 62-28 - Install Hold Down Tube


90000177

Fig. 62-29 - Hold Down Tube Fingers


90000178

Fig. 62-30 - Position of Long Side of Hold Down Tube

Major Repair - Fixed Motor (Continued)

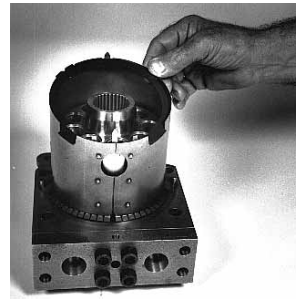
Place the slipper guide retainer shim on the hold down tube. The tab with the "V" notch must be positioned in the tube cutout which is located 45° counter-clockwise from the longest side of the tube assembly.

Assemble the bronze slipper guide bearing on top of the slipper guide retainer shim, positioning the tab with the "V" notch in the same position as noted above.

NOTE: Certain frame sizes utilize a one-piece slipper guide retainer shim and bearing. The one-piece shim and bearing is installed with the tab with the "V" notch positioned as noted above, and with its bronze side facing "up" (toward the slipper guide).

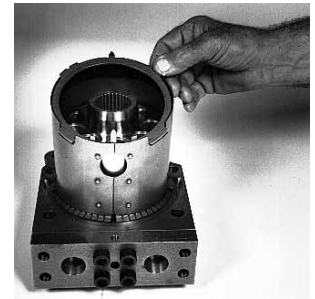
Assemble the piston assemblies into the slipper guide.

Lubricate the pistons and cylinder block bores. Install the assembled slipper guide and pistons into the cylinder block by inserting the pistons into the cylinder block bores. The pistons and bores are not selectively fitted, therefore no specific piston and bore orientation is required.



90000229

Fig. 62-31 - Install Slipper Guide Bearing Shim



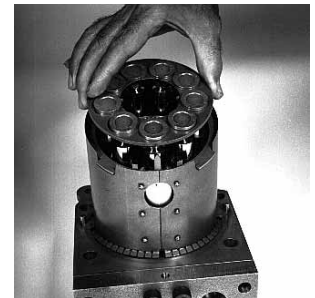
90000230

Fig. 62-32 - Install Slipper Guide Bearing



90000127

Fig. 62-33 - Install Pistons in Slipper Guide

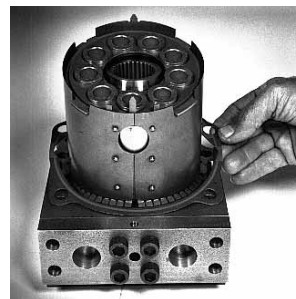


90000181

Fig. 62-34 - Install Slipper Guide and Pistons

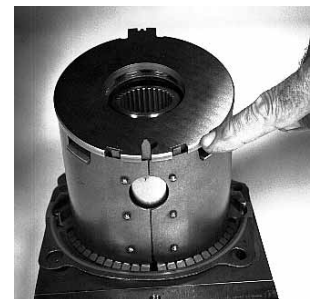
Place a new gasket on the end cap. The beaded side of the gasket must be positioned away from the end cap.

Lubricate the slipper running surfaces, then place the thrust plate on the slipper faces. The side of the thrust plate with the chamfered edge must be positioned away from the slipper faces. The slots in the thrust plate must be positioned over the tabs on the hold down tube.



90000182

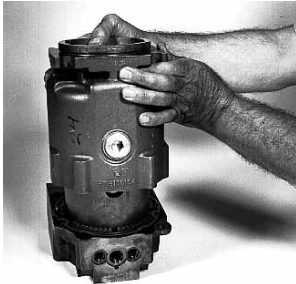
Fig. 62-35 - Install End Cap Gasket



90000231

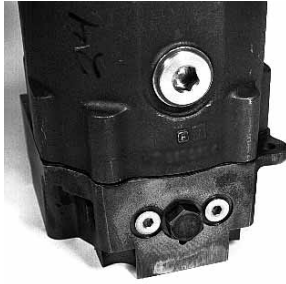
Fig. 62-36 - Thrust Plate Installed

Major Repair - Fixed Motor (Continued)



90000184

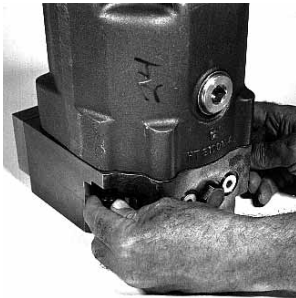
Fig. 62-37 - Install Housing



90000232

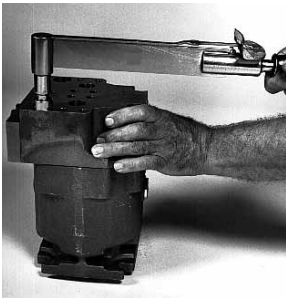
Fig. 62-38 - Housing Installed

Place the housing over the assembled internal parts, with the deep end of the cavity in the housing mated to the long side of the hold down tube. The housing will engage the alignment pins in the end cap. When the housing is properly installed, the hold down tube will hold the housing away from the end cap approximately 0.030 in. (.75 mm).



90000185

Fig. 62-39 - Install Shorter End Cap Screws



90000186

Fig. 62-40 - Torque End Cap Screws

Install and hand tighten the two (2) short end cap screws to hold the end cap to the housing.

Place the motor on the work surface with the end cap up, and install the remaining end cap screws. Tighten the end cap screws evenly to the torque indicated in the accompanying table.

Frame Size	Torque			
	Large Screws		Small Screws	
	lbf•ft	Nm	lbf•ft	Nm
030				
042				
055	90	122	30	41
075	70	95	38	52
100	150	203	38	52
130	150	203	38	52

Position the motor on its end cap.



90000225

Fig. 62-41 - Bearing Installed on Shaft



90000233

Fig. 62-42 - Install Shaft Assembly

Using caution to prevent damage to the sealing surface, press the roller bearing onto the drive shaft. (For units with a 3-piece bearing, press the inner race onto the shaft, then install the outer race/cage assembly and the special washer.) Install the bearing retaining ring onto the shaft.

Install the shaft and bearing assembly through front of housing, aligning the shaft spline with the cylinder block spline. Continue to lower the shaft into the unit and carefully align the end of the shaft with the end cap journal bearing. Then lower the shaft and bearing assembly into position.

Rotate the shaft by hand. The rotating assembly should turn freely. If it does not rotate freely, the motor must be disassembled and the problem corrected.

Major Repair - Fixed Motor (Continued)

Install the shaft seal as described in the "Minor Repair" section of the Series 90 Service Manual.

Rotate the motor shaft with a torque wrench to assure correct assembly. When properly assembled, the torque required to turn the shaft (after "break-away") should be within the ranges shown in the accompanying table.

Torque to Turn Shaft (Fixed Motor at 17°)		
lbf•ft (Nm)		
Frame Size	Minimum	Maximum
030		
042		
055	5 (6.8)	10 (13.6)
075	5.5 (7.5)	11 (14.9)
100	8.5 (11.5)	14 (19)
130	10.5 (14.2)	17 (23)

Assemble the following components as described in the "Minor Repair" section:

- Charge Pressure Relief Valve
- Loop Flushing Valve

Major Repair - Variable Motor

General

The procedures for the complete disassembly and reassembly (Major Repair) of the Series 90 Variable Displacement Motor will appear in a future revision of this publication.

Cleanliness is a primary means of assuring satisfactory hydraulic motor life, on either new or repaired units. Cleaning parts by using a clean solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material.

During the assembly of the Series 90 variable motor, all surfaces which have relative motion between two parts should be coated with a film of clean hydraulic oil. This will assure that these surfaces will be lubricated during start-up.

It is recommended that all O-rings and gaskets be replaced. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly. All gasket sealing surfaces must be cleaned prior to installing new gaskets.

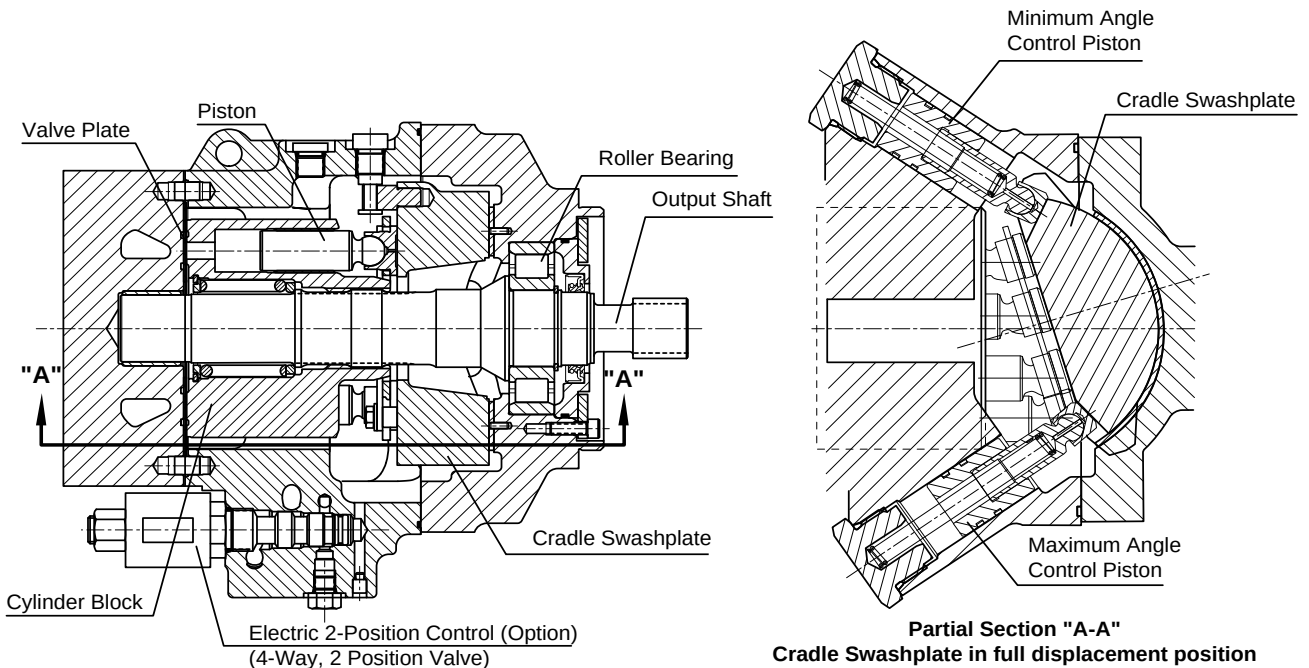


Fig. 63-1 - Cross Section View of Series 90 Variable Displacement Motor

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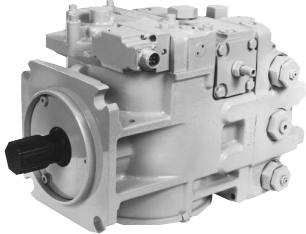
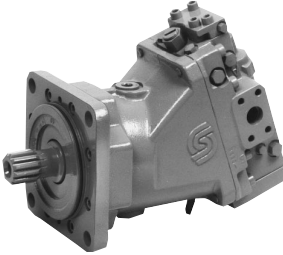
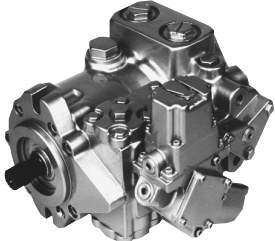
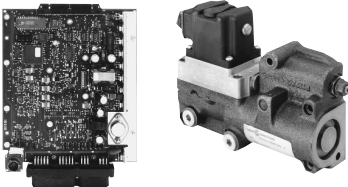
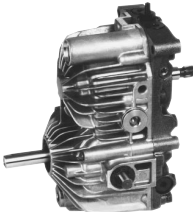
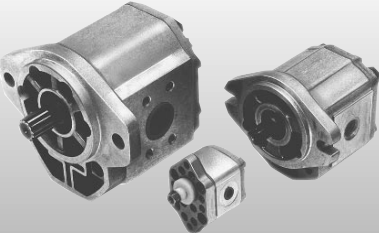
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